COMMONWEALTH OF PENNSYLVANIA.

DEPARTMENT OF AGRICULTURE.

BULLETIN No. 148.

FIRST REPORT OF THE

State Bee-Keepers' Association

OF

PENNSYLVANIA.

BY

PROF. H. A. SURFACE, Economic Zoologist and President Pennsylvania State Bee-Keepers' Association.

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VIRTUE
LIBERTY AND
INDEPENDENCE

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PREFACE.

Commonwealth of Pennsylvania,
Department of Agriculture,
Harrisburg, April 4, 1906.

There is at present time no more common subject of complaint among farmers than the scarcity and consequent high price of farm labor; and it therefore seems like a very opportune time to call attention to the industrious little toilers who are ready to work with untiring energy for all who are willing to provide them with good homes and healthful surroundings, and who make no greater demand for payment for the service they render than that they may retain for their own use enough of the wealth they accumulate to provide for their own subsistence and comfort.

Bee-keeping is regarded by those who have given the subject careful and painstaking attention, as being profitable, as well as productive of much pleasure. The demand for honey at the present time is largely in excess of the supply, and there is very little reason to believe that our markets will ever be over-stocked with the Golden nectar so grateful to the palate, and still less reason to fear that the supply of pasturage for the busy workers that gather it may ever run short.

The State of Pennsylvania abounds with the richest sources from which great supplies of honey may be drawn. On every hand, in forest and field, in valley and upon mountain top, the benevolent hand of Nature is holding out these supplies and inviting all who will to send out ready workers to gather them in. Beginning with the arbutus and maple in the early spring and ending with the asters and golden-rod in the late autumn, a constant variety of flowers yield their sweet treasures to the cheerful laborers, who never tire while there is work to do and weather fair in which it may be done.

Why then should we complain that help is hard to secure as long as we are unwilling to set to work whole communities of these busy toilers, who when tried and properly cared for have never violated the confidence of their friends.

It is a source of gratification to this Department to know that interest in Bee-Culture is reviving and that we have in the State of Pennsylvania an active Bee-Keeping Association. This Association was organized at Williamsport, Pa., on the 12th day of April, 1904, and held its first meeting at Harrisburg, December 6 and 7 of that year. The addresses delivered and the papers read at that meeting

are of too much value to be lost, and in order that they may be preserved, they are published in bulletin form. The President of the Association, Prof. H. A. Surface, who is an enthusiastic and practical Bee-Keeper, has kindly consented to prepare these proceedings for publication, and the bulletin is now sent forth upon its mission for good, in the hope that it may prove helpful to those who are already engaged in this profitable and pleasant employment, and that it may encourage others to take up this easy branch of industry.

N. B. CRITCHFIELD,
Secretary of Agriculture.

LETTER OF TRANSMITTAL.

Harrisburg. Pa., March 29, 1906.

Hon. N. B. Critchfield, Secretary of Agriculture, Harrisburg, Pa.:

Dear Mr. Secretary: I send you herewith copy for the First Annual Report of the Pennsylvania State Bee-Keepers' Association, which constitutes a Special Bulletin on Bee-Keeping Notes in Pennsylvania, which I have edited, and which consists of the papers presented at the Last Annual Convention of the Pennsylvania State Bee-Keepers' Association, of which I have the honor to be President.

There are certain facts about Bee-Keeping in this State, which are not generally known or considered, and I, therefore, take the liberty to outline some of them here, as I am in recent review of this subject and conversant with such facts, because they are in the line of my specialties.

There are about 28,000 bee-keepers in the State of Pennsylvania, and if each of these have three colonies (hives or "skeps") of bees, which is a low estimate, this means that there are 84,000 colonies of bees, and if these be worth $3.00 per colony, which is also low as a fair average, considering that modern hives cost from $2.00 to $3.00 per hive alone, it will be seen that the State of Pennsylvania has over $250,000 in the value of bees alone, and certainly $100,000 or a great deal more, in bee fixtures and apiary supplies. The annual production of honey in Pennsylvania is not less than 1,000,000 pounds, and at 15 cents per pound, this amounts to $150,000, making the value of bees, bee fixtures and honey in this State per year more than $500,000. This is, indeed, a low estimate, and is beyond any doubt very clearly within the bounds of accuracy. When we consider that there are some men in this State, such as Mr. O. C. Fuller, Turbottville, Pa., who has presented one of the papers submitted in the following pages, who are making bee-keeping their sole occupation, we can see that there are great possibilities of this comparatively undeveloped side-line of agriculture. There is no business connected with the production of food or clothing for mankind which, if properly handled, will give such a large percentage of income for so very small investment.

With the 84,000 hives of bees in this State, the production of honey in this Commonwealth by skillful bee-keepers could and would be made to average at least one hundred pounds per year for each colony, and this would mean over seven times as much honey production as there is at present. Our agricultural people are missing this income, because they are not familiar with the science and art of Agriculture or Bee-Keeping. Thus there is a loss of over 7,000,000 pounds of honey per year to the citizens of this State, which means a value of over $1,000,000, on account of the ignorance of modern

methods that have been proven by man to be as certain as the latest and most beneficial methods in horticulture or agriculture.

There is also an annual loss of at least one-fifth of the swarms in this State at swarming time, through the lack of knowledge of the methods of preventing the bees from escaping at such time, and this amounts to about 17,000 colonies. Counting these as worth $2.00 per colony, when the swarming is lost through failure to clip the wings of the queens and otherwise adopt modern methods in bee-keeping, it is a drain of at least $34,000 per year, through loss by escape from swarms.

From a recent report from Canada we have statistics that eighty per cent. of bees of that country were lost through winter killing. In this State every person who has attempted to keep bees knows that we are below the possible accurate estimate when we say that one-third of the bees of Pennsylvania have died by "winter killing," or as many as 33 1-3 per cent. are lost from this source each winter. This means at least 16,000 colonies, with a value of $3.00 per colony, making about $84,000 loss by "winter-killing." Nearly all of this can be prevented by up-to-date methods. Bee-keepers who understand modern methods lose but few from this source, while farmers generally lose at least one-half of their bees during each winter. This shows that a knowledge of the methods of keeping bees is very important.

Also, a very destructive bee disease, known as Foul Brood or Black Brood has broken out in some parts of this State, and has destroyed no less than 10,000 colonies of bees, and possibly three or four times as many. The least value of the bees annually lost by diseases, moths, etc., must be as much as $30,000, and this makes the grand total of loss of bees and honey in this State as much as $1,200,000.00, upon a basis of computation that will not be denied nor challenged by persons who are really familiar with the subject. Since the greater part of such loss is preventable by the dissemination of knowledge, and since the Report herewith submitted contains information necessary to the success of the bee-keeping interests of this State, and also the best methods of avoiding such losses, the Department of Agriculture is fully justified in issuing this as a special bulletin and thus granting the request of the many bee-keepers and farmers who have asked for the publication of such articles as those herein contained.

Respectfully submitted,

H. A. SURFACE,
State Zoologist and Pres. Pa. B.-K. A.

NOTES ON BEE-KEEPING IN PENNSYLVANIA.

Explanation.

By H. A. Surface, *President of the State Bee-Keepers' Association.*

Bee-keeping in the State of Pennsylvania is seriously neglected, while in other states it is receiving a considerable amount of attention and is developing accordingly. For example, in the State of New York there are several State inspectors for the disease known as Foul Brood, and a very active New York State Bee-Keepers' Association, which annually holds a series of Institutes in Bee-Keeping in various portions of the state, which are maintained by state appropriations, the same as Farmers' Institutes. This is resulting in greatly increasing the production of honey within the region embraced. Pennsylvania has the fruits, blossoms and cultivated and wild flowers holding nectar for far more than the annual production of honey than is now obtained, and she has sufficient persons engaged in bee-keeping to make her honey production very remarkable; but there are two things that are neglected: (1) Knowledge of the real principles of bee-keeping, and the methods of honey production, marketing, etc., and (2) failure of our bee-keepers to put such knowledge into practice; or in other words, negligence of the bee-keepers to follow scientific instructions and apply the principles involved in the science of Apiculture.

Our Pennsylvania State Bee-Keepers' Association was organized for the purpose of helping bee-keepers, and all who are interested in this subject are welcome to its membership and benefits. In the following pages will be found reference to this organization and the names of the officers. The same officers were continued after the first annual convention, and consequently are the same as here named.

The papers published in this bulletin are those presented at the First Annual Meeting of this Association, held at Harrisburg in December, 1904, and as they are by persons who fully understand their subjects, and pertain directly to bee-keeping in the State of Pennsylvania, it is quite appropriate that they should be published as a Special Bulletin by our State Department of Agriculture. All members of this Association will receive copies of this bulletin, and it is hoped that all interested persons in this State will be aided by it. The details of the business transacted at the Annual Convention are omitted from this Bulletin, as they may not be of great interest to the general readers, but they are duly recorded and kept

permanently by the Secretary. It is hoped that the proper State authorities will likewise see fit to grant the request of the Bee-Keepers of this State and publish the proceedings of the Second Annual Convention, as only by such means can the persons interested in receiving help be given the aid that is thus made available. Those who wish to make further inquiry of any subject pertaining to bee-keeping or to the Pennsylvania State Bee-Keepers' Association, are invited to correspond with either the President, H. A. Surface, Harrisburg, Pa., or the Secretary, Rev. D. L. Woods, Muncy, Pa.

CONSTITUTION OF THE PENNSYLVANIA STATE BEE-KEEPERS' ASSOCIATION.

Article 1.—Name.

This Association shall be known as the Pennsylvania State Bee-Keepers' Association.

Article 2.—Object.

The object of this Association shall be the promotion of scientific and practical bee culture, and the securing of such legislation as is necessary to protect and further the bee-keeping industry, and to advance the interests of its members.

Article 3.—Officers.

The officers of this Association shall be a President, three Vice-Presidents, a Secretary, a Treasurer, and an Executive Committee of five members, all of whom shall be members of this Association. Their duties shall be such as usually devolve upon the respective officers of similar associations.

Article 4.—Membership.

Section 1. Any person complying with the regulations of this Association, and paying one dollar yearly to the funds thereof, at any time, shall be a member, and shall be entitled to vote at the annual election of officers, and to participate in the deliberations of the Association, and receive the publications of the same, and also by so doing shall be a member of the National Association, entitled to its publications, legal protection and benefits.

Section 2. Any person interested in bee culture (including ladies) may become honorary members by a majority vote at a regular meeting.

Article 5.—Meetings, Election and Quorum.

Section 1. A meeting of the Association for the election of officers, transaction of business, presentation of papers and the discussion of topics of interest to progressive bee-keepers shall be held annually at such time and place as the Association shall direct.

Section 2. Special meetings may be called by the President and Secretary.

Section 3. Seven members shall constitute a quorum for the transaction of business, but a less number may enter npon a discussion of important topics and adjourn to some future day.

Article 6.—Amendments.

This Constitution may be amended by a majority vote at any annual meeting, of which amendment 30 days previous notice shall have been given, in writing, to every member of the Association.

THE PENNSYLVANIA STATE BEE-KEEPERS' ASSOCIATION.

OFFICERS FOR 1905.

PRESIDENT.

Prof. H. A. Surface, ... Harrisburg, or State College, Pa.

VICE PRESIDENTS.

E. E. Pressler, ... Williamsport.
W. A. Selzer, ... Philadelphia.
J. N. Prothero, ... DuBois.

SECRETARY.

Rev. D. L. Woods, ... Muncy.

TREASURER.

E. L. Pratt, ... Swarthmore.

EXECUTIVE COMMITTEE.

Richard D. Barclay, ... State College.
Charles N. Greene, ... Troy.
E. F. Phillips, ... Philadelphia.
E. A. Dempwolf, ... York.
John D. Costello, ... Harrison Valley.

MEMBERSHIP.

A full list of the members of this Association will be published in the next annual report giving also their addresses and the following facts about them as far as they can be ascertained:

1. Name and Address.
2. Number of Colonies.
3. Kind of Bees.
4. Kind of Hives.
5. Amount of comb honey produced in 1905,.....
   in 1904,.....
   in 1903,.....
   in 1902,.....
6. Amount of extract of honey produced in 1905,.....
   in 1904,.....
   in 1903,.....
   in 1902,.....

   and the number of colonies each season that were engaged in the production of the above mentioned honey?

7. What periodicals or journals on Bee-Keeping are taken?
8. Chief honey-producing plants and date of blooming of each.
9. Membership in State, National and Local Bee-Keepers' Associations.

All persons keeping bees in the State of Pennsylvania, whether members of the Association of not, are requested to send to the President, at Harrisburg, such detailed replies to the above questions as they can give, either of their own apiaries or those of their neighbors, whose names and addresses are also requested.

CIRCULAR OF INFORMATION.

The following circular was sent by the Secretary to every Bee-Keeper whom he could reach in this State:

The Pennsylvania State Bee-Keepers' Association.

The Pennsylvania State Bee-Keepers' Association was organized at Williamsport, April 12, 1904, and held its First Annual Convention in Harrisburg, December 6th and 7th, 1904. The officers for the year ending December, 1905, are as follows:—President, Prof. H. A. Surface, State College, 1st Vice President, E. E. Pressler, Williamsport, 2d Vice President, W. A. Selser, Philadelphia, 3rd Vice President, J. N. Prothero, DuBois; Secretary, D. L. Woods, Muncy; Treasurer, E. L. Pratt, Swarthmore; Executive Committee, Richard D. Barclay, State College, Charles N. Green, Troy; E. N. Phillips, University of Pennsylvania, Philadelphia; E. A. Dempwolf, York, and John D. Costello, Harrison Valley.

The chief purpose of this organization is to promote Apiculture in Pennsylvania and it is to be accomplished by efforts made along the following lines: (1) To secure legislation for the promotion of bee-keeping. (2) To suppress the diseases of bees, especially foul brood, by legislation and by the appointment of a competent State Inspector with deputies or assistants. (3) To secure and promote instruction in bee-keeping at Farmers' Institutes. (4) To secure a series of lectures at the normal sessions for Farmers' Institute Lecturers each year. (5) To make it possible for persons to obtain instruction in apiculture at the Pennsylvania State College. (6) To induce and promote investigation and experimentation in apiculture at the Pennsylvania State Agriculture Experiment Station. (7) To induce and promote investigations and publications by the Division of Zoology of the Pennsylvania State Department of Agriculture. (8) to Enforce the laws against the adulteration of honey. (9) To secure laws against spraying fruit trees while in bloom. (10) To obtain statistics concerning bees and bee-products within our State. (11) To enter upon a crusade of apicultural education in this State, both for producers and consumers of honey. (12) To instruct fruit growers and farmers as to the practical value of bees as agents in the fertilization of the bloom of their plants, and to show the fact that they are wholly beneficial and never injurious. (13) To raise the rank of Pennsylvania as a honey-producing state from fourth in the Union to first, if possible. (14) To band together all the bee-

keepers of the State for the purpose of good fellowship and that strength, which is to be obtained only by union. (15) To make it possible for persons not now keeping bees to add to their revenues by the production of honey, and to increase both the quantity and quality of the honey produced in this State.

The first year of the Association's history has not been insignificant. The membership has not become what it should, but is by no means discouraging. Our industry was given place on the program of the Normal Farmers' Institute Lecture Course in October, 1904, at Bellefonte. The First Annual Convention, mentioned above was by no means unimportant, consisting as it did of five sessions, the proceedings of which will be published in the Report of the Department of Agriculture. As one of the results of the Association's work, instruction in Apiculture may now be obtained by correspondence from State College, and experiments and practical investigations in bee-keeping are now commenced there. An attempt was made to secure the passage of a bill providing for the suppression of bee diseases. Was it a failure? Yes, for this time. But it must not be in the end. Will you help next time?

It is now necessary as far as possible, to enlist every bee-keeper in the State to give his personal support and influence to the Association that its membership may be largely increased, and the full advantages of its avowed purposes may be obtained for all bee-keepers. To this end, every person receiving this circular is urged to become a member and is asked to assist in getting others to do so by sending lists of bee-keepers' names to the secretary, and by speaking to their bee-keeping friends about this important subject. The membership fee is one dollar a year which includes the fee for membership in the National Bee-Keepers' Association. All members will receive (free), the publication of both Associations.

Dear reader, are you interested? If so will you not promptly fill out and return to the secretary the accompanying application blank with One Dollar for the payment of your membership fee? Its receipt will be promptly acknowledged.

Correspondence is earnestly solicited.

D. L. WOODS, Secretary, Muncy, Pa.

H. A. SURFACE, President, Harrisburg, Pa.

Application for Membership in the

PENNSYLVANIA BEE-KEEPERS' ASSOCIATION.

Please enroll my name as a member of the Pennsylvania State Bee-Keepers' Association. I enclose one dollar ($1.00) in payment of my first annual membership fee, with the understanding that the secretary will forward fifty cents ($.50) of the same to the National Bee-Keepers' Association, and that thereby I shall be constituted a member of both Associations.

Name .....

Town ..... County .....

Number of colonies kept .....

REPORT OF THE FIRST ANNUAL MEETING OF THE STATE BEE-KEEPERS' ASSOCIATION OF PENNSYLVANIA, HELD AT HARRISBURG, PA., DECEMBER 6 AND 7, 1905.

The attendance throughout was good and much interest manifested in the papers and discussions.

This being the first meeting there was considerable important business transacted, all of which is carefully recorded in the minutes of the Secretary. Therefore it is not necessary to publish the details of the business section, but the program and the following papers are here recorded because of the great value of the facts contained in these papers, which were prepared by men who rank among the most prominent in the world to write on such subjects. Although the important discussions of these valuable papers must be omitted from this report, it is hoped that it may be found possible to insert such in the next.

Program of the First Annual Convention of the Pennsylvania State Bee-Keepers' Association, held in Harrisburg, Pa., December 6 and 7, 1904.

2.00 P. M. Tuesday, December 6.

Minutes of the Williamsport (Organization) Meeting.
Report of the Secretary.
Report of the Treasurer.
Reports of Committees.
Appointment of Committees.
Unfinished Business.
New Business for the consideration of the Association.
Report of Convention of the National Bee-Keepers' Association, Mr. E. E. Pressler, of Williamsport.

7.30 P. M. Tuesday, December 6.

Address by the Governor.
Response and President's Address.
Paper by Dr. E. F. Phillips, of the University of Pennsylvania. (Title to be announced later.)

9.00 A. M. Wednesday, December 7.

Reports of Committees.
Diseases among Bees and Their Treatment, Hon. N. E. France State Inspector of Apiaries for Wisconsin and General Manager of National Bee-Keeper's Association.
Bee-Keeping as a Business, O. C. Fuller, Northumberland county.
Bees and Horticulture, Gabriel Hiester, Harrisburg.

1.30 P. M. Wednesday, December 7.

Paper by Mr. E. L. Pratt, of Swarthmore, Delaware county. (Some Queen-Rearing Subject.)
Education in Apiculture, Richard D. Barclay, State College, Centre county.
Question Box, by Members.

7.30 P. M. Wednesday, December 7.

Improvement of Honey Bees, Mr. Frank Benton, Washington, D. C., in charge of Apiculture, U. S. Dept. of Agriculture.
Honey-Bearing Flora, Rev. W. H. Bender, New Chester, Adams county.
General Discussion, by Members.
Reports of Committees and Business.
Question Box, by Members.
Adjournment.

FIRST ANNUAL ADDRESS OF THE PRESIDENT OF THE PENNSYLVANIA STATE BEE-KEEPERS' ASSOCIATION.

BY H. A. SURFACE, *President.*

In attempting to deliver this, the first annual address of the President of the Pennsylvania State Bee-Keepers' Association, I deem it important to give a brief resumé of what we have accomplished during the portion of the year that we have been in existence, and to indicate some of the important work that is before this Association. I hold in my hand a circular concerning the organization of our Association, which contains the following statements:

"Pursuant to a call for a convention of the Bee-Keepers in Pennsylvania a number of persons met at Williamsport on April 12, and organized the Pennsylvania State Bee-Keepers' Association with the following officers: President, Prof. H. A. Surface, State College; 1st Vice President, E. E. Pressler, Williamsport; 2nd Vice President, W. A. Selser, Philadelphia; 3rd Vice President, J. N. Prothero, Du Bois; Secretary, D. L. Woods, Muncy; Treasurer, E. L. Pratt, Swarthmore; Executive Committee, Richard D. Barclay, State College; Charles N. Green, Troy; Prof. E. N. Phillips, University of Pennsylvania, Philadelphia; E. A. Dempwolf, York, and John D. Costello, Harrison Valley.

"The chief purpose of this organization is to promote Apiculture in Pennsylvania, and it is to be accomplished by efforts made along the following lines: (1) To secure legislation for the promotion of bee-keeping. (2) To suppress the diseases of bees, especially foulbrood, by legislation and by the appointment of a competent State Inspector with deputies or assistants. (3) To secure and promote instruction in bee-keeping at Farmers' Institutes. (4) To secure a series of lectures at the normal session for Farmers' Institute Lec-

turers to be held in Bellefonte next October (5) To make it possible for persons to obtain instruction in apiculture at the Pennsylvania State College. (6) To induce and promote investigation and experimentation in apiculture at the Pennsylvania State Agricultural Experiment Station. (7) To induce and promote investigations and publications by the Division of Zoology of the Pennsylvania State Department of Agriculture. (8) To enforce the laws against the adulteration of honey. (9) To secure laws against spraying fruit trees while in bloom. (10) To obtain statistics concerning bees and bee-products within our State. (11) To enter upon a crusade of apicultural education in this State, both for producers and consumers of honey. (12) To instruct fruit growers and farmers as to the practical value of bees as fertilizing agents for their plants, and to show the fact that they are wholly beneficial and never injurious. (13) To raise the rank of Pennsylvania as a honey-producing state from fourth in the Union to first, if possible. (14) To band together all the bee-keepers of the State for the purpose of good fellowship and that strength, which is to be obtained only by union. (15) To make it possible for all persons who are not now keeping bees to add to their revenues by the production of honey, and to increase both the quantity and quality of the honey produced in this State.

"The Association desires the name and address of every man in the State who has one or more colonies of bees, and for this purpose invites persons to correspond either with the President or the Secretary, stating the number of colonies or hives kept, and giving statistics as to the amount of honey and wax produced each year. The membership fee is only one dollar per year, which also entitles the individual to membership in the National Bee-Keepers' Association, and gives him special protection and assistance at any time that it may be required. For example—if a member of the National Association becomes involved in litigation the National Association will furnish expert testimony and counsel such as may be necessary to secure equity in the courts of justice.

"This commendable undertaking should receive a large membership, and all persons interested are invited to send their names, addresses and fees to the secretary, and these will be registered and receipted.

"The next meeting will be held in Harrisburg during the first week in December, when several papers will be presented by practical and expert men, bearing upon the various problems of the bee culturists in our State.

"Correspondence is earnestly solicited.

"D. L. WOODS, Secretary, H. A. SURFACE, President.
"Muncy, Pa. Harrisburg, Pa."

Some of the objects cited in the above circular have been already obtained. For example, we have secured the instruction of bee-keeping at Farmers' Institutes in this State, and any institute that desires a special lecture or series of lectures upon this subject by a practical expert, can obtain them, without additional charge, by corresponding with Hon. A. L. Martin, Deputy Secretary of Agriculture and Director of Institutes, at Harrisburg. At the Farmers' Normal Institute of this State, held at Bellefonte and State College last October, one of the most interesting addresses, which received

universal commendation, was upon "Practical Methods in Bee-Keeping," by Mr. R. D. Barclay, of State College. This shows the accomplishment of item No. 4. To meet No. 5, Dr. Atherton, President of the Pennsylvania State College, is preparing to offer a course including instruction in bee-keeping for young women and men who may wish to make a professional and practical study of the so-called "side issues" of farming, fruit growing, poultry keeping, bee-keeping, berrying, floriculture, etc. The fact that the proceedings of this meeting are to be published in the Annual Report of the State Board of Agriculture is enough to show that the purpose set forth in item No. 7 is also to be met. A series of lessons in Apiculture has been prepared and issued in the Correspondence Course of the Pennsylvania State College, and as these are free to all persons who want them, this bespeaks an additional scope of our educational influence in connection with the College and the Experiment Station. Preparations are now being made for the speaker to establish an Apiary at the Pennsylvania State Agricultural Experiment Station, and thus to accomplish purpose No. 6. To secure the legislation mentioned in the above circular demands uniform effort, and I recommend that steps be taken in this convention to draft and secure the passage of such bills as we may agree upon. Concerning the adulteration of honey I have to cite such an example as the following: Shortly before our organization last spring I purchased so-called liquid honey at twenty-five cents per pint, which I knew was mostly glucose, because it had neither the flavor nor sweetness of honey. It was, of course, extracted and adulterated afterwards

A few days ago I went into the same store and examined the same preparation and found over the original label a more recent one had been pasted, upon which was printed "Honey Mixture: one part honey, two parts glucose." This jar sold for only fifteen cents, although it was exactly the same in every particular as that for which I had formerly paid twenty-five. This means that the value of pure honey is to be maintained by exposing frauds and adulterations and enforcing the law and compelling these cheap substances to be sold for what they are, rather than in competition with the genuine article.

In Pennsylvania there are about twenty-eight thousand bee-keepers, who produced last year about two million five hundred thousand pounds of honey, and which would load a freight train one mile in length. Our State has not usually been regarded as a great honey-producing state because this subject has not been properly brought before the public. Today the field is open, the ground is fallow and the soil is fertile; it remains for us to plant and cultivate the seed which will result in good fruit for ourselves and future honey-producers. Let us be encouraged by what has already been accomplished in less than a year, and push forward with the expectation of increasing our membership, and securing the other aims of our organization. In Union there is strength.

Before us is a crusade of education which demands the energy and attention of every intelligent person interested in bee-keeping or honey production. This is to be fourfold, as follows:

I. The Education of the Public.—(1) The public should be educated to know the true value of pure honey and its medical, health-giving

and health-preserving qualities. Since it is a food-stuff already predigested, being an inverted sugar, and prepared by the bees ready for digestion to be completed in the human stomach, it can in many instances be eaten by invalids when other sweets can not be taken. Honey is to be found upon my own table every day, and if I were to speak from personal experience I should say that I am sure our appetites are keener, our food more highly relished, our health much better, and our bills, especially for butter and meat, considerably reduced by virtue of the use of this important product of the bees. (2.) We must educate the public in the evils of using adulterated honey, which although it may contain such an apparently harmless adulterant as glucose, has not the sustaining qualities of honey. (3.) We must impress upon our friends the fact that comb honey can not be made artificially and can not be adulterated, and consequently in buying capped or sealed honey they are buying that which has been prepared only by the instrumentality of "The Little Busy Bee." (4.) We must also educate the public to understand that honey in the store-room may be granulated, although pure, and in fact granulation or sugaring, especially in cool weather, is an evidence of absolutely pure honey. We should educate them to understand that the most suspicious product on the market is the extracted or liquid honey in jars with a little piece of comb floating at the top. No true bee-keeper ever prepares his product in this way. (5.) Our friends should be educated on the subject of buying honey. They should know where to buy it, and when they learn this they will agree that buying directly of the producer is the best way to obtain the best product at the lowest price. However, it is possible for us to establish in the large trade centres of this State a regular trade with certain firms who will make their reputation and ours by handling our products in a reliable manner, which will prove satisfactory to both producers and consumers. (6.) We should use every effort to show the absurdity of the canard or false statement, now unfortunately being circulated in some papers, to the effect that there is manufactured or artificial comb-honey. Let us emphasize this by making known the fact that the National Bee-Keepers' Association, of which we are members by virtue of having joined the Pennsylvania Association, has a standing offer of one thousand dollars forfeit for any comb honey capped or sealed in such a way as not to be detected. (7.) We must educate our fellow citizens, especially our horticultural friends, to understand fully the fact that bees are decidedly beneficial about their premises, do not puncture any fruits, and not only aid in increasing their fruit crop, but in fact are essential for the production of certain kinds of fruit by cross fertilization. (8.) Let us endeavor to call the attention of every bee-keeper in this State to the importance of joining this Association and aiding us in securing the desiderata named above, and let us educate our political friends concerning the serious troubles that confront us in the presence of destructive bee diseases and legislation that we need in suppressing these, as well as for other purposes.

II. The Education of Merchants or Storekeepers.—(1.) The dealers in food stuffs should be educated to the importance of knowing and saying what is good, and selling only pure articles, which will stimulate and build up trade, rather than poor stuff that will destroy it. (2.) Merchants should understand that pure honey will granulate,

especially if kept very cool, and that this granulation is due to no defect in the product. However, it can be overcome by placing the jars cantaining honey in vessels of water, and heating them gradnally and slowly until the honey has all become clear and liquid and then holding them at that temperature for a short time. It will not granulate again soon. (3.) Storekeepers should be taught to keep honey from granulating by preventing it from becoming either very cold or very warm. (4.) They should be tanght to push the sale of honey and honey-products and thus to place before the public one of Nature's best food stuffs. (5.) It is important for us to show merchants not only how to sell, but where and how to buy. For this, our own Association is justified in having its representative visit their stores, and we should prepare our honey in the most attractive manner and show merchants how to keep it so. (6.) They should understand the importance of legislation against adulteration and should join in a movement against this serious evil.

III. The Bee-Keeper, or the Producer, should be Considered in this Educational Crusade. (1) He should know how to detect the presence of diseases in his apiaries upon their first occurrence, and how to eradicate such troubles. (2.) He should know how to improve his stock by keeping careful records of each colony and rooting out the poorer queens and propogating from only the best. (3.) He should know how to keep bees and at the same time avoid difficulties with neighbors. A section of honey occasionally handed over the line fence will be found one of the best remedies for bee stings or laundry soiled by early flight, and will insure privilege of entering other premises to reclaim departed swarms. (4.) He should know where and how to secure his supplies, what to use and how to use it, and he should understand the importance of using uniform and interchangeable parts in the entire apiary. (5.) He should have a system of marketing, the basis of which was expressed by one who said, "I place the best honey on the outside of the shipping case, and then fill all the rest of the space with just the same grade." He should have a regular market and develop this by the excellence of his product, his method of shipping, and especially by having his name and address plainly stamped or printed on each package. He should increase the consumption of honey by using it himself at hotels and public places, showing that he has faith in the virtue of his own product. By calling for honey at hotels and having his friends do the same, he can aid in increasing the demand upon merchants or beekeepers for good honey. (7.) He should co-operate with the U. S. Department of Agriculture, Bureau of Apiculture, take advantage of Prof. Benton's good work, and plant seeds of honey-bearing plants, not only such as may be found in our own State, but also such as are sent to us occasionally for experimental purposes. (8.) He should understand the necessity of union in such an organization as ours, and even though he may keep but a few bees, he should be with us for the good we are trying to do. (9.) He should understand the importance of legislation in behalf of the neglected subject of beekeeping in this State and endeavor to induce his legislators to take such action as will aid to place us upon such safe footing as that held by some of our neighboring states.

IV. Education of Legislation.—The legislators of our State should understand that honey production is an agricultural factor not to

be despised in a state which contains twenty-eight thousand bee-keepers, maintaining one hundred and sixty-one thousand colonies or hives of bees, and ranking fourth in the union in the number of colonies and fifth in the number of pounds of honey produced. This is without impetus from any source, and the possibilities of our State in this direction are immense. However, our industry is threatened by a serious disease that is killing our bees as a blight and a scourge. We ask legislators not only to aid us in legislating against adulterated honey and other food-stuffs, but also in granting us a State Inspector of Apiaries and a system of inspection, such as has proven so efficient in wiping out this dreaded disease from several other states in the Union. Only by serious and united effort can we hope to succeed.

THE HABITS OF THE BEE AND SOME MISAPPREHENSIONS.

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Of all animals, aside from man himself, there are very few that have been the object of more admiration and interest to men of every age than the common honey bee. The domestic animals have, of course, been the objects of much study, but it is much to be doubted whether they surpass the bee in interest. On account of its value to man as a honey producer, as well as because of its most interesting habits, but few insects are as well known as is the hive bee, Apis mellifera.

It may be profitable for us to review together for a short time some of things that we know about bees, and it has occurred to me that possibly it might be even more profitable to find out what we do not know. There yet remains much to be done along the line of observations on the habits of the bee, and lest we forget that we do not yet know all that is to be known, let us first examine the difficulties in the way of observation and then hastily review our present knowledge in so far as our time will allow.

First of all, let us give credit to the men who in the past have spent their time in observation, for by their labor we of the present are enabled to read in a short time the results of years of work and profit in the practical work of apiculture by their recorded results. He would be an ignorant bee-keeper indeed who would fail to acknowledge his debt of gratitude to the men who have worked on the habits of the bee, for apiculture is founded on their work and would not exist to-day as a science were it not for such workers. The names of Aristotle, Swammerdam, Reaumur, Bonnet, Schirach, Huber and others well known to you, must ever be venerated by bee-keepers for the light these men threw on the activities in the hive. Huber, with his loss of sight, stands out among these as an example of a man who could do work of the greatest value in spite of an affliction which would make most men of little value to mankind at

large. Later we come to the names of Dzierzon, the founder of the theory of Parthenogenesis, Von Berlepsch, Von Siebold and Weismann. We must also include Langstroth, Cowan and possibly Cheshire in the list, for they have done much in apiculture. There are many more men whose work has helped, but we cannot enumerate all of them. I regret to say that relatively few Americans have done much toward a scientific study of the bee, but what this nation lacks on that side has been more than made up in practical appliances and methods. The source to which every bee-keeper should go for a knowledge of the habits of the bee is not a book written by any of the men that I have named, nor of any other man, but the one place to study the habits is beside a bee hive. First-hand information, properly obtained, is worth more than any amount of second-hand facts and here, as everywhere, we can profitably follow the advice of the celebrated naturalist Agassiz, "Study Nature, not Books."

The study of the behavior of animals is not easy. I am well aware that many persons think that they could not want an easier task than to study the habits of the bee, but there are difficulties which make such work very trying and unsatisfactory.

In the first place, it is often hard to see just what a bee is doing. Let us take an example what happens when we shake the bees from a frame in front of the hive entrance. In a short time a few bees nearest the entrance turn their heads toward the opening and begin to fan their wings; others soon do the same, and before long almost every bee is fanning as if its very life depended on it. Gradually they begin to move toward the entrance and enter the hive. Every bee-keeper has seen this repeatedly, especially when hiving a swarm, but how many could tell what is going on among the bees. This action has been referred to as the "joyful hum" of the bees as expressive of their pleasure at finding again the hive in which they belong. Others have said that the noise of those nearest the hive is heard by the bees farther away, and they know where the colony is located. Whether bees can hear or not is a question which need not be discussed here, but these conclusions are inaccurate because the observations are incomplete. If you will carefully notice this particular action at the next opportunity you will see that the abdomen is raised to an angle of about forty-five degrees and that the last segment is bent down exposing a light yellow strip between it and the next anterior segment. On this yellow area there appears a glistening drop of some fluid and when the bee begins to fan a very peculiar odor is easily detected even by the human nose. Bees are, as is well known, governed largely by scent and this particular action consists in the fanning back of the odor produced by this liquid. The difficulty in earlier observations was that the whole attitude and action was not observed, and consequently the conclusions were incorrect. It is not so much because this is hard to see, but because the observers were satisfied with a partial observation, that we long remained ignorant of this important habit. We pride ourselves on our ability to see things, yet any person who has investigated the subject knows how difficult it is to get two people to tell the same story concerning any observation; and this is not because their eyes do not see alike, but because they perceive only part of the event and let their imaginations

fill up the gaps. In no place is this human fault more noticeable than in work on observation of habits, and as a result I feel free to say that this is one of the most difficult problems in the study of animals.

A second difficulty, is that of giving reasons for the things observed. We are not satisfied with mere observations of actions unless we can see why they are performed, for otherwise the action is meaningless. Since the bee is constructed on a plan so totally different from ourselves, we often are unable to interpret the habits and doubtless many important things are still unknown for this reason.

A third difficulty, and one to which too much attention cannot be called, is the difficulty of distinguishing between verifiable and unverifiable truth. As an example, let us take the action of the worker bees towards the queen. The actual observation is this: The workers surround the queen on the comb and touch her with their antennæ. Whenever she approaches a worker as she moves over the comb the worker turns toward her and at once begins touching her with its antennæ. So much all observers see, but here they separate. One says the workers hold the queen in greatest respect and that they care for her and caress her because they know that on her depends the life of the colony; another observer denies all ability of a worker bee to feel any affection or similar emotion. Now who is right? No one can tell, for at the present time this is unverifiable. The actual movements are verifiable by any observer, but when we try to explain the inner feelings of an insect we enter the realm of unverifiable truth, where our imaginations are our only guides, and consequently our results are worse than worthless. This is the rock on which many observers of bees are shipwrecked. If only there were some way to eradicate the unverifiable statements from the books on bees what a marvelous advance it would be. The very best writers are at fault here and scarcely a bee journal appears that does not contain some such statements.

As another example of this, allow me to quote from one of the more recent works, the author of which may perhaps remain unmentioned.

"The antennæ, in some mysterious way, afford means of communication. By them the bee says all it feels to its friends and relatives.

"Watch two bees meet on a window frame; they instantly cross feelers, and if they come from the same hive there ensues such an outpouring of bee talk, such a tremor of crossed antennæ, such an evident condition of excitement all through their bodies, as might well fill the most practised gossip with envy.

"One can imagine the graphic terms in which they relate the recent awful experience of their capture, how they were suddenly and rudely jerked from a sweet blossom, and after indescribable shaking about in a strange thing made of bands too close together for them to get through and too tough for them to bite through, finally found themselves, as they supposed, free.

"The joy after the fear! but alas, their happiness was of short duration; for when they attempted to return to the clover field

visible in the distance, they found themselves suddenly checked in mid-career by what seemed a wall of thickened air, a strange, hard, cold, transparent nightmare of a barrier which they could see through, but could not pass.

"Poor little bees. No wonder their antennæ fly in the discussion of such strange facts, and how fortunate that the ears of the ogre, their captor, are not attuned to the remarks of their antennæ, as they express their opinion concerning him morally, mentally and physically."

Truly this author has wandered far afield in the realm of the unverifiable! I am not one of those who would eliminate all the poetic from our daily life nor would I fetter the imagination as long as it leads to the truth but to put such an array of obvious fabrication into a book which is intended to instruct us on bees is far from justifiable. It is just this sort of thing which has caused many persons to look with disfavor on much of the so-called "Nature Study" of our schools. It is really a pity that this author did not discover that there are more wonderful facts concerning the bee which were verifiable than any which were concocted to fill the book.

The three things which I have mentioned are difficulties which even men have who are well trained in observation. It takes much practice before the observations made by any person are of any value, and if we could but prevent people from publishing their results until they really know how to observe what a blessing it would be to apiculture. There are other obstacles which we continually meet, such as the tendency to generalize from one or two observations, and the drawing of wrong conclusions because of bad logic. We may find examples of these later, but there is one other grave fault of which I wish to speak before leaving this subject. I refer to the use of the word "Instinct."

I have no desire at this time to go into a discussion of the causes and nature of Instincts. An instinct may be defined as a natural impulse, leading animals, even prior to all experience, to perform certain actions tending to the welfare of the individual or the perpetuation of the species, apparently without understanding the object at which it may be supposed to aim or without deliberating as to the best methods to employ. There are many actions of the bee which are carried out by newly-hatched bees and for which we can see no cause. The difficulty here is that whenever an observer comes across an action which he cannot understand, and for which he can find no method of formation, he throws it into the general pile of "instincts" without further effort to find a cause. Is it not evident that what we so often call instincts are but actions which we do not understand? I believe, and I am not alone in my belief, that every instinct has a physical cause in the structure of the animal or its environment, and unless we do our utmost to arrive at the ultimate cause of these actions we have not finished our problem. There is a tendency for all men to think that when they have a name for a thing and can use the word fluently that they understand all the details of the question, but we must constantly avoid this. As an example of this, let us take the duties of the bees at different ages. Briefly, they work as follows: For the first day or two the

young bees do not work on account of their weak condition, but they soon take up the duties inside the hive, such as wax-building, nursing the developing larvæ, cleaning the hive, etc. Later, generally when about sixteen to nineteen days old, they begin to fly from the hive and ordinarily never do any of the inside work of the hive which they did before. Of course it must be understood that varying conditions may change their actions, but this is what normally happens. Young bees do, of course, fly from the hive in what is called their exercise flight on warm afternoons, but they do not go so far from the hive but that they can be guided back by their sense of smell. Why do they go through this cycle? We can, of course, say that instinct impels them to do all these things, but how much more do we know about it when we have given a name to the impulse unless we look farther?

I have not investigated this problem very much, and do not wish it understood that I think that I have arrived at the ultimate and complete cause of this cycle of action, but certain facts seem to me to indicate that there is an organic cause back of all this. The large compound eyes, as well as the ocelli of the young bees, are covered with fine hairs, each one of which is much longer than a single unit of the eye. These hairs are not sensory, as Cheshire claims, since they are in no way connected with the nervous system. I can also see no reason why they should be considered as protective since the chitinous lens of the eye is very dense and seemingly needs no protection of this kind. These hairs come off gradually and by the time the bee is ready to fly they are nearly all gone. I do not wish to make the mistake of failing to distinguish between accompanying and casual factors, but I am inclined to the belief that these hairs on the young bees so obscure their vision that they do not fly from the hive to forage because they cannot see clearly enough to do so. As we know, young bees do fly for exercise, but as before mentioned, only so far that they might be guided back by scent.

Whether my view is correct or most erroneous, all must admit that it is no worse than the position of the man who says that it is all due to instinct, for he doesn't know anything about it and I profess to know but little.

That bees as well as other animals do certain things instinctively is too evident to be discussed, but what we now need, above all else, in the study of habits is to recognize the fact that the word "instinct" is too often a confession of ignorance and we must look for other and more fundamental causes where possible.

I have enumerated at some length the difficulties and liabilities of error in a study of the habits of the bee, and if I could but impress on every bee-keeper the fact that these really exist I would be thankful. On the other hand, I know of no more favorable animal for study than the honey bee, and if I spend more time on the difficulties than on the advantages it is because the favorable side is better known.

The work of others in the past makes it possible for us to begin where they left off, and this advantage applies particularly to work on bees, where so much has already been done. The interest which we have in the bee from a commercial standpoint makes the work easier, for a person working on bees is doing something of interest to

many people, and but few of us have reached that height of scientific perfection where we do not care for at least some popular interest in our work. Lastly, the numerous modern appliances of apiculture make it possible for us to study bees under many varied conditions, and these changed conditions bring out peculiarities in the habits which would not be seen, except with difficulty, under ordinary conditions. Movable frames, observation hives, mating nuclei, and swarm boxes are of inestimable value in the study of habits.

In discussing the habits of the bee it is hard to know where to begin. Perhaps there is no better way to arrange what is to be said than to follow a colony through a season, taking up the various phases of their activities in the order in which they occur in nature. We can thus avoid unnecessary repetition and still get in all the desired points.

In the spring of the year the colony consists of a queen, whose duties consist in laying the eggs in the cells of the comb, and many workers or undeveloped females. At this time there are no males or drones. During the winter the bees remain quiet, and the queen lays no eggs, so that in the spring there are no developing bees in the hive. The supply of honey is then also low, for they have eaten their stores all winter and none has been collected and placed in the cells. As soon as the days are warm enough the bees begin to fly from the hive in search of the earliest spring flowers. From these flowers they collect nectar, which is transformed into honey, and pollen, which they carry to the hive on the pollen baskets on the third pair of legs. The nectar is taken into the bee's mouth and then passes to an enlargement of the alimentary canal, known as the honey-stomach, where it is acted upon by certain juices secreted by the bee. On its arrival in the hive the bee places its head in one of the cells of the comb and deposits there the nectar which it has carried in. By this time the nectar has been partially transformed into honey, and the process is completed by the bees by fanning the cells to evaporate the excess of moisture which still remains. When a cell has been filled with the thick honey the workers cover it with a thin shee of wax, unless it is to be eaten at once. The pollen is also deposited in cells, but is rarely mixed with honey. The little pellets which the bees carry in are packed tightly into cells and if a cell of pollen be dug out of the comb one can usually see the layers made by the different pellets. This collecting of nectar and pollen continues throughout the summer and ceases only with the death of the last flowers in the autumn.

Almost as soon as the honey and pollen begin to come in, the queen of the colony begins to lay eggs in the cells in the center combs. The title of queen has been given to the female bee which normally lays all the eggs of the colony, under the supposition that she governs the colony and directs its activities. This we now know to be an error, but the name still remains. Her one duty in life is that of egg-laying. She is most carefully watched over by the workers, and is constantly surrounded by a circle of attendants who feed her and touch her with their antennae; but she in no way dictates what shall take place in the hive. The eggs are laid in the bottom of the hexagonal cells, being attached by one end to the center of the base. The first eggs laid develop into workers, and are deposited

in cells one-fifth of an inch across. As the colony increases in size by the hatching of these workers, and as the stores of honey and pollen increase, the queen begins to lay in larger cells, measuring one-fourth of an inch across, and from the eggs laid in these cells drones develop. The size of the cell does not determine the sex, as will be explained later; but the queen almost invariably lays the worker eggs in the smaller cells and the drone eggs in the larger ones. As these male eggs develop and hatch, drones begin in the colony, generally about the first of May in temperate climates.

The eggs do not develop directly into adult bees, as might be inferred from what has just been said; but after three days there hatches from the egg a small white worm-like larva. For several days the larvae are fed by the workers, and the amount of food consumed is truly remarkable. The larva grows rapidly, until it fills the entire cell in which it lives, and then the workers cover the cell with a cap of wax while the larva inside spins a delicate cocoon under the cap. The worker brood can at once be distinguished from the drone brood by the fact that the workers place a flat cap over worker brood and a high arched cap over drone brood; and this often is of great help to the bee-keeper in enabling him to determine at once what kind of brood any hive contains. Twenty-one days from the time the egg is laid the young worker-bee emerges from its cell, having gone through some wonderful transformations during the time it was sealed up, this stage being known as the pupa stage. For drones the time is twenty-four days.

About the time the drones begin to appear, the inmates of the hive begin to prepare for swarming, which to any one watching the habits of bees, is one of the most interesting things that takes place in the colony.

The workers now begin to make queen-cells. In our previous description of the development of the young from the egg, nothing was said about the queen, and there are some decided differences in her growth which we will now take up.

As was stated earlier, the queen and the workers are all females. Schirach, an old authority on bees, discovered that the bees can take a young worker larva soon after it hatches from the egg, and, by giving it special food, royal jelly, all during its larval life, and, by constructing for it a special cell, make of the otherwise worker larva a fully developed queen. This it is that the workers of a colony do when they are preparing to swarm. Several young worker larvae are chosen as the material for queen-rearing, generally located near the margin of the comb. The workers now begin to feed these chosen larvae an extra amount of food, and at the same time the sides of the cells containing them are remodeled and enlarged by the destruction of surrounding cells. The queen (or royal) cell is nearly horizontal at the top, like the other cells of the comb, and projects beyond them; later the workers construct another portion of the cell into which the queen larva moves. This is an acorn-shaped cell placed vertically on the comb, about as large as three ordinary cells. As the cell is being built the queen larva continues to grow until the time comes for her to be sealed up and enter the pupa state. Although it takes the worker twenty-one days to complete its development, the queen passes through all the stages and reaches a considerably larger size in but sixteen days.

Before leaving the subject of the raising of queens, it might be well to state that if, for some reason, a queen is killed in the hive, or by chance gets lost, the workers can at any time replace her by the same method, provided, of course, they have worker larvae on which to work. In the same way they will replace or supersede an old queen when she begins to show signs of decreased power of egg-laying, so that this peculiar performance is not characteristic of swarming only.

In the swarming season, at about the time the new queens are ready to leave their cells, the old queen leaves the hive and takes with her a part of the workers, this being known as "swarming." This generally takes place in the morning of a warm pleasant day. It may as well be confessed that we know very little about this remarkable instinct of the bee. In the first place, under ordinary conditions, the old queen would not allow queen-cells to be constructed in her colony, nor has any one told us why she allows it now. Neither do we know what starts the actual swarming, nor which bees, workers or queen, first set the hive in motion. We are equally ignorant of what is the thing which compels certain bees to leave with the old queen and why the others stay in the old hive with the young queen. Since the prevention or control of swarming is such an important problem in practical apiculture, the value of research along this line is evident. Since our original hive has now divided, let us follow the swarm with the old queen and later return to the old hive to observe the actions of that.

In the hands of a bee-keeper the departing swarm may be put into another hive, provided he wishes to increase the number of his colonies; but in nature the swarm will find an old hollow tree or some similar place in which to establish itself. The bees, before leaving their old hive, fill themselves with honey until the abdomen is greatly distended, and for this reason it is not necessary for them to collect nectar for a day or two, for they have other work to do. Some of the bees begin to clean up the new quarters and get it fit for occupancy; but most of them begin the construction of new combs. To do this they suspend themselves in curtains from the top of the hive, and remain motionless for some time. The wax used in building comb is secreted by the workers in eight small pockets on the lower side of the abdomen while they thus hang in curtains. Finally, after considerable wax has been thus formed, they begin to build. The small flakes of wax are passed forward to the mouth, there mixed with a salivary secretion to make them pliable, and then are placed against the top of the hive. Other workers then come and place their small contributions of wax on those first deposited, and this continues until the combs are finished. There is more to comb-building than the mere sticking on of wax plates, however; and nothing in all bee habits is more wonderful than the beautiful plan on which they build the comb. The cells are hexagonal in shape, so that each cell in the center of the comb is surrounded by six others; nor is this the only remarkable thing in their architecture, for each comb is composed of a double row of cells, the base of each cell being formed of three parts, each one of which is likewise a part of a separate cell on the other side of the comb. By this method the bees obtain the greatest possible capacity for their

cells with the least expenditure of wax. The accuracy of the cells of the comb has in all ages been an object of admiration of naturalists and bee-keepers; and while the degree of perfection assigned to these cells has undoubtedly been over-stated by most writers, yet we can not but admire and wonder at the remarkable instinct, almost bordering on intelligence, which enables the bees to build cells so well suited to their purpose.

As soon as there are some cells constructed, and even before they are entirely completed, the queen begins to lay eggs, and the workers begin to collect stores of honey and pollen. They also collect in considerable quantity a wax-like substance from various trees, commonly called propolis, with which the inside of the hive is made tight, closing up all openings except the one which serves as an entrance. In this way the new swarm prepares for itself an abode like the one it left; and by sealing up the crevices and gathering stores it prepares for the coming winter.

We may now return to the colony which remained after the swarming took place to see what happens there. The colony left in the old hive retains all the brood and honey stores, and has a newly hatched queen. There is then no necessity for wax building nor for sealing up the hive; but this colony is already in a normal condition except that the queen is not yet ready to perform her duties, and she will receive our attention now. A very young queen receives little attention from the workers, but goes about the combs practically unattended. When about five days old (the exact time depending on the weather), in the afternoon, the virgin queen flies from the hive to mate with a drone. She first takes several short, preparatory flights to get her hive located so that she may find it on her return, and finally she flies upward in constantly enlarging circles, high in the air. Thus far she may be easily followed; but few have been fortunate enough to observe the actual mating. Sometimes the mating takes place at a lower point, and a few men have recorded the fact of witnessing the completion of the mating flight. The queen, on leaving the hive, in some way attracts a great many drones to her from all parts of the apiary, provided her hive is located in a bee-yard, and the swiftest and strongest is successful in the race. The other drones often follow the queen back to her hive, and for an hour or two remain on the outside of the hive after she has entered, but later they return to their former hives.

The queen returns from the mating-flight in about half an hour, carrying with her the generative organs of the male, which is killed during the union of the two. Near the posterior end of the queen is a small sac, which, before the flight, is filled with a clear liquid, but after her return this sac is filled with an opaque fluid; and it is the reception of this opaque substance which is the essential thing in mating. This liquid contains millions of spermatozoa, or male sex cells, each one of which is capable of fertilizing an egg as it glides past the opening of the sac. This supply of spermatozoa is almost always sufficient to supply the eggs laid by a queen for three or four years—it rarely happening that she mates a second time before laying. Since a queen can, during her lifetime, lay a total of 500,000 eggs, most of which receive one of these spermatozoa, it will be seen that the apparatus for preserving them is very perfect,

since the queen cannot generate more, and they do not divide or increase in number in any way.

The mating of queen and drone never occurs in the hive, but always in the air, on the wing. This fact prevents what is known as in-and-in-breeding; for, if the queen mated in her hive she would receive spermatozoa from her brothers, and we know that such close breeding is undesirable in all forms of life. The cause of the undesirable results of in-breeding are yet a mystery; but we do know that they follow, and this habit of the queen of mating outside the hive renders close crossing less probable. After the queen has returned to her hive, the workers remove the male organs. These parts of the male are not absorbed by the queen, as is sometimes claimed; but the spermatozoa contained in them are taken into the spermatheca and the rest dries up and is removed. Almost as soon as the queen returns from her flight there is a difference in the treatment which she receives from the workers. It happens at times that she is not received kindly after taking her flight, and may be killed by the workers, which do not recognize her as their queen, probably on account of some new odor which she has acquired during her absence. This is rare, however, for ordinarily she is the object of much attention on her return. From this time on, whenever she stops for a moment on the comb, either to deposit an egg or to rest, she is surrounded by the workers. In about two days after mating the young queen begins to lay, and this one duty she performs until her death, never again leaving the hive except with a swarm.

The colony with the young queen is now in the same condition as the one which left the hive, both having laying queens, combs, brood, and a sealed hive. Their histories, under normal circumstances, are then practically the same. Both prepare for winter, and the following spring both cast swarms again, and so the cycle is repeated. Such is the activity of bees under favorable conditions; but, needless to say, this ideal is not always realized, and we will now follow colonies under other conditions.

Let us take a colony with a virgin queen like the one left after a swarm is cast. It sometimes happens that the queen is defective in some way so that she can not fly from her hive to meet a drone. This may be caused by mutilated or weak wings, or possibly the queen shows no disposition to fly. On the other hand, the weather may not be favorable for her flight, or there may be no drones in the air when she does fly. Evidently, any of these conditions will prevent mating; and when this occurs we are enabled to see one of the most remarkable phenomena of the hive. The observer who wishes to study this phase of bee activity may bring about the same conditions by cutting off the wings of the queen or by covering the entrance of the hive with perforated zinc so that it is not necessary to depend on chance to bring about what we are now to observe.

If a queen remains unmated for a period of three weeks she is incapable of mating, and loses all desire to leave the hive to meet a drone. After that time she may begin to lay eggs, but, strangely enough, these eggs produce nothing but drones and the queen is then what is known as a "drone layer." Obviously then, drones are produced from eggs which have not been fertilized. Not all

unmated queens become drone layers; in fact, many queens die if not mated and many others never lay at all; but if any eggs are laid they produce only drones. From my own experience in trying to bring about this condition I can say that the person wishing to verify the statements made concerning this strange phenomenon should start several virgin queens in hives and possibly one or two will lay.

This introduces us to one of the most remarkable phenomena which is known to occur in nature, but it is not characteristic of bees alone. In the vast majority of cases in the animal kingdom eggs disintegrate unless fertilized by spermatozoa of the same species. Just why fertilization is necessary is still a disputed point among scientists; but we know that it is necessary in most cases. To the development of eggs without the usual fertilization the name "Parthenogenesis" is applied.

The parthenogenetic development of drones was first completely described by Johannes Dzierzon, a priest of Karlsmarkt, Germany, and a bee-keeper of long experience. It has since been verified by many workers on the subject. As the eggs pass down the oviduct on their way from the ovaries of the queen they pass the opening of the spermatheca, and if the egg is to become a female it receives from this spermatheca one, and only one, spermatozoon; if it is to become a drone it receives no spermatozoon, and consequently remains unfertilized, as do all the eggs of a drone layer. A normally mated queen rarely lays a drone egg in a worker cell, or vice versa, provided both kinds of cells are present, and consequently we are forced to the conclusion, as much as we dislike to admit it, that the queen in some way can control the laying of eggs of different sex, but how this is done is a mystery. I say we dislike to admit this because it is entirely beyond our comprehension and as stated in the earlier part of this talk, one of the difficulties in recording observation is the giving of reasons for things observed.

Another fact which supports the theory of parthenogenesis is that workers in a colony which is hopelessly queenless will often begin to lay eggs. As we have said, workers as well as queens are females, but they are incapable of mating, and the eggs laid by them produce nothing but drones.

This statement of the theory of parthenogenesis or the "Theory of Dzierzon," as it is commonly called, differs from the usual statements of the theory that find place in the books on apiculture. The Theory of Dzierzon can be divided into two parts. (1) Drone eggs are unfertilized while female eggs are fertilized. To this part all observations lead us to subscribe. (2) All the eggs in the ovary of the queen are male eggs and the fertilization of the egg changes its sex and it becomes female.

The latter portion of the theory is not founded on actual observation but on logic only, and not on sound logic either. Let us state the theory in a different manner. Male eggs are unfertilized and female eggs are fertilized. As far as we can see this is the only difference between them, and since we can see no other difference this must be the thing which changes the sex. Is it not clear that the conclusion does not necessarily follow, for is it not possible that there is some difference between these eggs not yet observed, which is the all-determining factor, rather than that fertilization is?

Fertilization may have nothing to do with sex-determination: (1) Nowhere else is the animal kingdom, except in animals exhibiting parthenogenesis, is it claimed that fertilization has any influence on sex. (2) The ants, which were formerly considered to be similar to the bee in their parthenogenesis, sometimes, according to some recent work, have females produced from unfertilized eggs. (3) In the vast majority of cases where the problem of sex has been investigated there is strong evidence that the sex of the offspring is determined before the egg leaves the ovary. (4) Certain observations made during the past two summers tend to show that there is some other difference between male and female eggs.

In studying the problem of parthenogenesis I was struck by the illogical conclusion concerning sex, and to test the theory spent some considerable time in observations on the subject. I found that many of the eggs laid by a drone-laying queen never develop at all. According to the theory as propounded by Dzierzon and his followers, all the eggs in the ovary are male and if they are unfertilized all should develop and become drones. But all do not develop. I have observed drone-laying queens in one-frame observation hives, and in eight-frame hives, and in all my observations there were always a considerable number of eggs which dried up and did not develop. Of course, all that did develop became drones.

From these facts it is posisible that the sex may be determined in the ovaries before fertilization. Male eggs do not require fertilization, and therefore can develop when laid by a drone-layer, but the female eggs of a drone-layer require fertilization, and since they do not get it they die. I am as yet unable to give an exact ratio between the number of eggs which develop and those that do not, owing to difficulties in observation, but of the fact that some do not develop I am sure.

Of course, it will be recognized that this is but a theory with a somewhat small basis of fact, but the facts observed seem to me to be enough to throw doubt on the second part of the Dzierzon theory —that sex depends on fertilization. For fear of being misunderstood, let me repeat that my observations confirm the view that drone eggs are unfertilized, so that the first part of the Dzierzon theory remains unchallenged, as far as I am concerned. The entire subject of the parthenogenetic development of the drones is still but little understood. A few facts are well known, but around these facts there has been woven a mass of good and bad guesses which must be cleared up. If the theory could be stripped of these surmises, the whole subject would be much clearer; and one who undertakes to work on this line must drop all but well-verified facts.

There is one other line of work on bees in which I have been interested for some time and on which there is yet considerable work to be done. According to the views of the majority of zoologists, the variation of animals is the result of crossing of two lines of heredity. In other words, worker bees would tend to vary all the way between their two parents while drones would tend to be like their single parent. This is certainly logical, but by this time we know that it is not possible to figure out in advance what animals are going to do. To test this I have measured something over a thousand each of drones and workers. In this work I chose cer-

tain characters on the wings, for reasons which need not be discussed here. Briefly my results are as follows: Drones vary considerably more than workers, rather than less, as we would logically conclude; and furthermore, this variation depends more on the environment under which they are raised than on any inherited tendency. Some as yet unpublished measurements confirm this view most strongly.

I have mentioned but relatively few of the habits of the bee, and if I seem to have taken the view that our present knowledge is meager I hope you will overlook it if you think me pessimistic. The study of the habits of the bee are of the utmost importance to apiculture and since so much remains undetermined, let us hope that many will be enough interested to take up the work. My acquaintance among bee-keepers is not as wide as I would wish, but let me say that the best and most successful that I know are the ones who most carefully study their bees. On this account I urge the necessity for still more work on the habits.

I have carefully avoided a discussion of modern appliances in bee-keeping, and especially cut very short any mention of queen-rearing, since this subject will be ably discussed to-morrow by a man who knows that subject better than I do. It is not because I undervalue the practical side of bee-keeping that I have confined my remarks to more theoretical matters, but because I fear that most apiarists rather undervalue the so-called theoretical work concerning the bee. I hold that one depends on the other, and neither one alone will ever be a full success. This is my justification in giving expression to the views and facts here spoken.

FOUL BROOD AND OTHER DISEASES OF BEES.

By Hon. N. E. France, *Wisconsin State Inspector of Apiaries, Platteville, Wis.*

Foul Brood—Bacillus alvei, is a fatal and contagious disease among bees, dreaded most of all by beekeepers. The germs of disease are either given to the young larval bee in its food when it hatches from the egg of the queen bee, or it may be by contagion from a diseased colony, or if the queen deposits eggs, or the worker bees store honey or pollen in such combs. If in any one of the above cases, the disease will soon appear, and as the germs increase with great rapidity, going from one little cell to another, colony to colony of bees, and then to all the neighboring apiaries, thus soon leaving whole apiaries with only diseased combs to inoculate others. The island of Syria in three years lost all of its great apiaries from Foul Brood. Dzierzou in 1868 lost his entire apiary of 500 colonies. Cowan, the editor of the British Bee Journal, recently wrote: "The only visible hindrance to the rapid expansion of the bee industry is

the prevalence of Foul Brood, which is so rapidly spreading over the country as to make beekeeping a hazardous occupation." Canada's Foul Brood inspector, in 1890 to 1892, reported 2,395 cases, and in a later report for 1893 to 1898, that 40 per cent. of the colonies inspected were diseased.

In Wisconsin I know of several quite large piles of empty hives, where all the bees have died from Foul Brood; also many other apiaries where said disease had gotten strong foothold. By the kindness of the Wisconsin beekeepers, in most cases, I have, during the last eight years, gotten several counties free from disease, and at the present writing, May 27, 1905, have the disease under control. Foul Brood is often imported into Wiscinsin, so we must expect new cases until all States have such laws as will prevent it. Arizona, New York, California, Nebraska, Kansas, Colorado, Utah, Ohio and Texas have County Inspectors. Wisconsin, Illinois and Michigan have State Inspectors. Copy of Wisconsin laws are now pending in legislatures of Pennsylvania, New Jersey, Maine, Minnesota, South Dakota, Idaho and Washington.

CAUSES OF FOUL BROOD.

Causes of Foul Brood.—1. Not from chilled, pickled, starved, or any form of dead brood. But such conditions are most favorable for growth of disease. Foul Brood germs do not float in the air. If they did, why would not every brood cell in an infected hive become diseased?

2. Bees sold, having disease, and new locations thus inoculated.

3. Combs, or implements from one apiary used by others in their apiaries.

4. Robber bees, getting honey from infected combs,—greatest danger.

5. Buying queen bees from infected apiaries. To be perfectly safe in this deal, on arrival of queen, place her alone in a clean queen cage with plenty of good honey. Introduce her in this last cage, and burn the just received cage and attendant bees, and no evil results, even from such queens out of infected hives.

EXPERIMENTS.

Exeriments.—1. A Wisconsin beekeeper had foul brood among has bees so bad that he lost 200 colonies with it before cured. Having an extractor, wax press, etc., at home, he placed the bees in boxes while he boiled the hives, extracted the honey from all the combs and boiled the honey, also all combs making beeswax into comb foundation. He then placed the bees in their same hives on foundation made from infected combs, and fed the infected BOILED honey. Ten years has passed and no signs of disease there since.

(2). Comb foundation made by supply dealers is perfectly free from any danger of disease. To prove this I took a quantity of badly infected combs, rendered the wax myself, and had two of the extensive manufacturers of comb foundation make into foundation this lot of wax. Then selected twenty of the best apiaries in Wisconsin, where no disease ever was known and in sixty-two colonies placed this foundation. Five years have passed and no signs of disease in any of those hives.

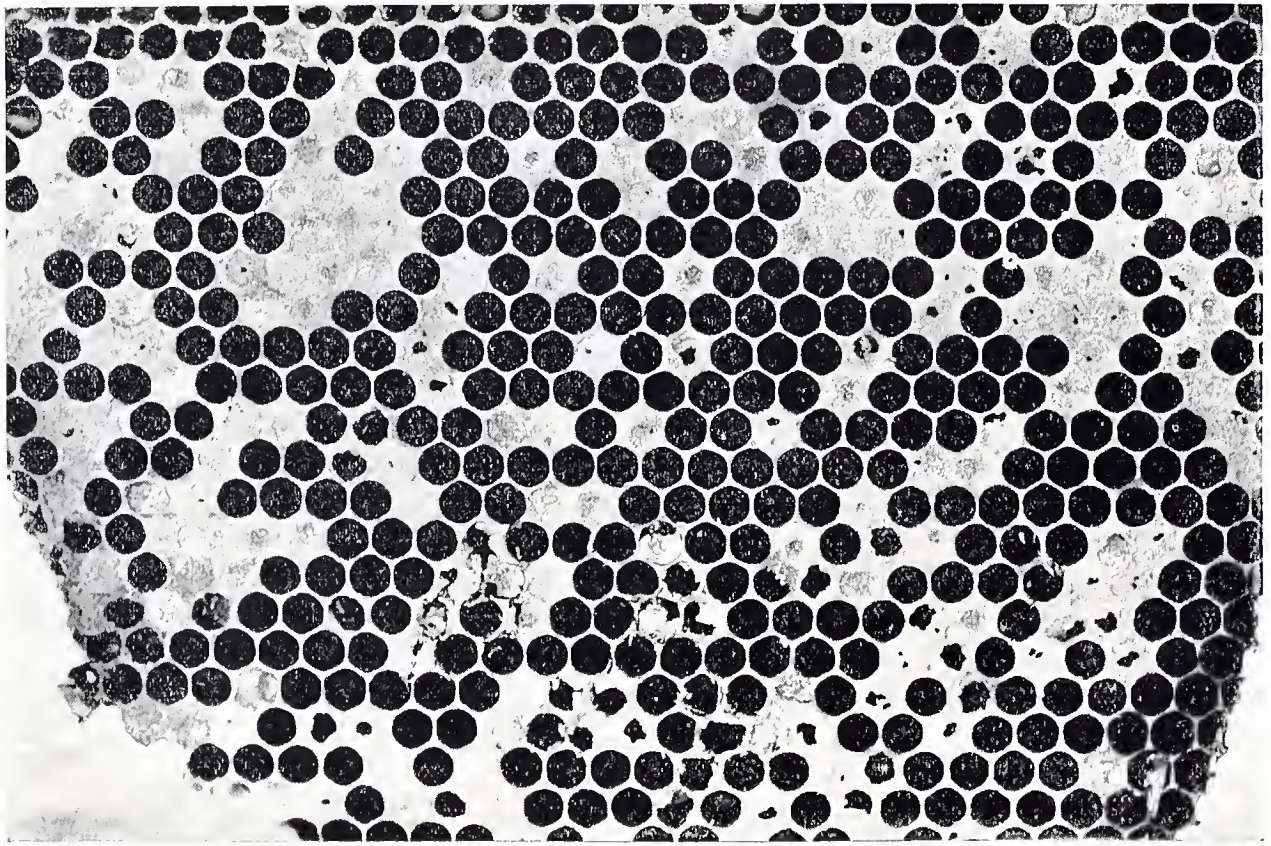

PLATE I.—Comb with Foul Brood. By N. E France, Platteville, Wis Loaned by Mr. W. Z. Hutchinson, Flint, Mich., Editor of *Advanced Bee Culture*, in which it was originally published.

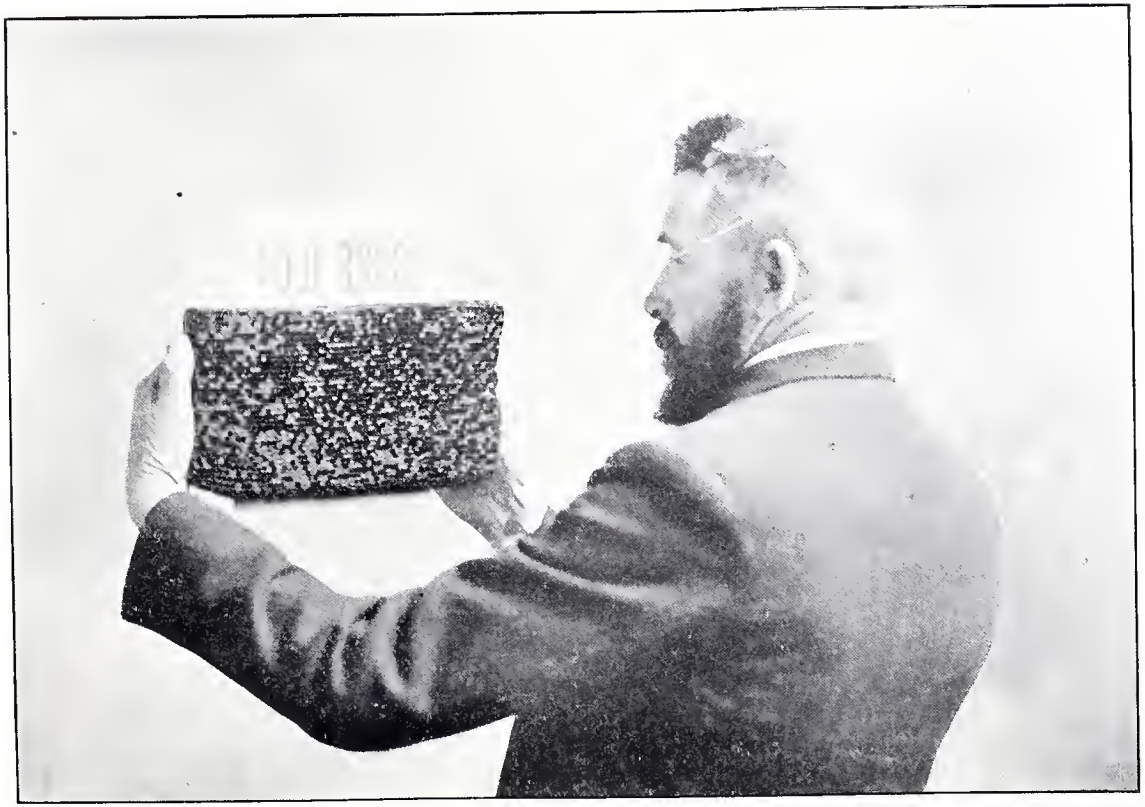

PLATE II.—Detecting Foul Brood. By N. E. France, Platteville, Wis. Loaned by Mr. W. Z. Hutchinson, Flint, Mich., Editor of *Advanced Bee Culture*, in which it was originally published. The white line shows the proper angle for the rays of light to fall.

(3). Honey or wax from a sun heat extractor, is not safe to use until same is boiled.

SYMPTOMS OF FOUL BROOD.

(1). Brood in combs badly scattered, many empty cells, (See Plate I), cappings dark and sunken, some with holes in cappings, part of the brook hatching while others are dead. The dead larvæ of a dark brown color, or blackish according to age. The lightest colored will upon inserting a tooth pick draw out much like rubber or glue, and at that stage has most odor, much like stale glue when warm.

(2). Dried Scales.—If the disease has reached advanced stages all of above conditions will be easily seen. According to its age of development there will be either the shapeless mass of dark brown matter on the lower side wall of the cell, or the dried scale. This scale nearly black and dried hard to wall of comb as thin as side wall of the cell. The head of the bee often dies in a small bunch and turned up some. In size, about half size of pin head.

HOW TO DETECT FOUL BROOD.

Take out carefully the oldest hatching brood in the hive, and first see if the cappings are smooth or sunken and scattered, with some having small holes in the cappings. This is more noticeable in old black combs. Now bring the brood comb right side up to the level of your chin, tip the top of the comb towards you so your view strikes the lower walls of brood cells about one-third distance from front. Next turn your body so that bright daylight comes over your shoulder and shines in each cell where your view of suspected disease is found, (See Plate II). The white line in this picture shows the angle I want the light to come in each brood cell. Gas or electric light will not take the place of sunshine or strong daylight.

On the lower side wall, just back from front end of the cells, will be seen the apparently dead foul brood, nearly black, with a sharp pointed head slightly turned up. The body portion of the bee flattened to a mere black lining of its cell, no thicker than one side wall of the comb cells. The other side walls and bottom of the cell look clean. The scales, if present as described, are a sure proof of foul brood. Such infected combs must be burned or melted in boiling water, thus killing all disease and saving the wax. Diseased combs melted by sunshine heat will not kill all disease. I always use abundance of boiling water in saving wax from old combs. I first melt the combs in large kettle of boiling water, and when all melted and well stirred, is then strained through the wax press, thus saving everything of any value.

TREATMENT.

McEvoy Treatment.—In the honey season when the bees are gathering honey freely, remove the combs in the evening and shake the bees into their own hives; give them frames with comb foundation starters and let them build combs for four days. The bees will make the starters into comb during the four days and store the diseased

honey in them which they took with them from the old comb. Then in the evening of the fourth day take out the new combs and give them comb foundation (full sheets) to work out, and then the cure will be complete. By this method of treatment all the diseased honey is removed from the bees before the full sheets of foundation are worked out. All the old Foul Brood combs must be burned or carefully made into wax after they are removed from the hives, and all the new combs made out of the starters during the four days must be burned or made into wax, on account of the diseased honey that would be stored in them. All the curing or treating of diseased colonies should be done in the evening, so as not to have any robbing done, or cause any of the bees from the diseased colonies to mix and go with the bees of healthy colonies. By doing all the work in the evening it gives the bees a chance to settle down nicely before morning, and then there is no confusion or trouble.

TO PREVENT SWARMING OUT WHEN TREATED.

This same method of curing colonies of Foul Brood can be carried on at any time from May to October, when the bees are not getting any honey, by feeding plenty of sugar syrup in the evenings to take the place of the honey flow. It will start the bees robbing and spread the disease, to work with Foul Brood colonies in warm days when the bees are not gathering honey, and for that reason all work must be done in the evening when no bees are flying.

When the diseased colonies are weak in bees, put the bees two, three, or four colonies together, so as to get a good sized swarm to start the cure with, as it does not pay to spend time fussing with little weak colonies. When the bees are not gathering honey, any apiary can be cured of Foul Brood by removing the diseased combs in the evening and giving the bees, frames with comb foundation starters on. Then also in the evening feed the bees plenty of sugar syrup and they will draw out the foundation and store the diseased honey which they took with them from the old combs; on the fourth evening remove the new combs made out of the starters and give the bees full sheets of comb foundation and feed plenty of sugar syrup each evening until every colony is in first-class order. Make the syrup out of granulated sugar, putting one pound of water to every pound of sugar, and bring it to a boil. As previously stated, old combs must be burned or made into wax and so must all new combs made during the four days. No colony is cured of Foul Brood by the use of any drug.

All the difference from the McEvoy treatment that I practice,—I dig a deep pit on level ground near the diseased apiary and after getting a fire in the pit such diseased combs, frames, etc., as are to be burned are burned in this pit in evening and then the fresh earth from the pit returned to cover all from sight. Often I use some kerosene oil, a little at a time being poured on old brood combs or those having much honey in, as they are hard to burn. If diseased combs with honey in are burned on the surface of the soil there is great danger; the honey when heated a little will run like water on the soil and in the morning the robber bees will be busy taking home the diseased honey that was not heated enough to kill germs of Foul Brood.

I also cage the queen while the bees are on the five or six strips of foundation. It helps to keep the colony from deserting the hive and going to other colonies.

I do not believe in, or practice burning any property such as hives, bees, beeswax, or honey that can be safely treated and saved. Many times it is poor economy to save all, and as so many beekeepers are not so situated as to keep all diseased material from robber bees while taking care of it, I take charge of the treatment, using my wax press to save all the beeswax that would have been wasted.

BEE-KEEPING AS A BUSINESS.

By O. C. Fuller, *Chillisquaque Apiaries, Tarbotville, Pa.*

The subject of bee-culture as a sole business has been discussed pro and con in the bee papers and bee-keepers' text books until it is about exhausted. Yet how many bee-keepers are making the culture of bees their sole business in the fullest sense of the term? I think they could be counted on the fingers of one hand. But in taking up this subject we must consider it in the sense we understand it in the language of the bee-keeper. Literally speaking, it would mean that the bee-keepers do nothing but keep bees for a livelihood. As that condition hardly exists we shall have to consider the subject in a little different light,—as one's principal occupation or specialty.

As bee-keeping is naturally a rural pursuit, it follows that the great majority of bee-keepers own or live on small pieces of land, which they cultivate to some extent as an adjunct to their regular business of keeping bees, and the income from this source must of course be reckoned as a part of the proceeds of the business. The bee-keeper may perhaps keep a horse, a cow, a few hens, and several hogs, the proceeds from which very materially adds to his income, and yet not destroy his just title of specialist. We cannot truthfully say that the farmer is any less a farmer or that he does not pursue the business of farming, because he does some odd jobs for a neighbor with his team or some work in a different line in the winter months when there is a slack time on the farm. Therefore we shall have to consider bee-keeping as a business on these same lines. I, however, agree with Mr. Hutchinson, in his paper read at the St. Louis convention, that general farming or any other occupation that takes up the greater part of one's time, will not work with bee-keeping, and is therefore not admissible as an adjunct to the successful cultivation of the honey bee. Yet we cannot ignore the fact that a large proportion of the bees in Pennsylvania are kept upon the farms. It is advisable that farmers keep a few bees to fertilize the blossoms of the field, orchard and garden. The bees thus kept generally supply the farmer's table with honey, and he often has some to sell besides, although the amount is not equal to

that taken by the specialist, and is almost always inferior in appearance, due generally to neglect and failure to give the proper attention to the bees when storing. But with all this neglect, almost allowing the bees to shift for themselves, we frequently hear farmers say that their bees are the most profitable thing on the farm. If bees are profitable when kept on the farm, as a side issue, then they must be very profitable when kept without another hampering occupation in the way.

I venture the assertion, without the risk of contradiction, that there is no other rural pursuit that will bring the returns in ready cash that bee-keeping will, taking into account the capital invested and labor involved.

Bee-keeping has always been considered by some as an uncertain and risky business, due to the fact that flowers fail to yield nectar in some seasons, and to the heavy winter losses which have frequently taken place. To the first, I would say that we do sometimes have poor seasons when bees do not gather a surplus of honey for their keepers, but those seasons come only occasionally and the profit secured from the bees in the good seasons ought and will carry the bee-keeper over the poor ones. In speaking of the winter losses, I would say that they are not so great now as they were in former years, due largely to the fact that bee-keepers are learning more about the wintering problem. By giving proper protection during winter (other conditions being equal), there need be no great fear on that score, if the bee-keeper thoroughly understands his business. I, therefore, believe that the investment of capital in the bee business is attended with no greater risk of loss than if invested in any other legitimate business venture.

If we have once decided to make bee-keeping our business, and have any hampering prefixes or suffixes coupled with it, we must begin at once to amputate at both ends if we expect to have a full measure of success. There are critical times in every apiary when the apiarist cannot possibly be bothered with any other work and must put in full time with his bees.

A successful bee-keeper can never afford to procrastinate, for procrastination is the thief of honey and money to the apiarist. If we put off for a single day the giving of more surplus room to the bees, when needed, it means the loss of many dollars, in a large apiary.

We will now look about us and see what conditions are necessary to the successful prosecution of the business. First and the most important factor in my opinion is location. Fortunately, our old State of Pennsylvania is very lavish in giving us a great variety of honey-producing flora, and I do not think there is a single locality in the State that would not support from ten to one hundred colonies of bees. In looking about for a good location for our apiaries, we should take the lay of the ground and the abundance of honey-bearing flowers into careful consideration. The character of the soil should also be studied. If I were to choose the ground for an apiary, I should try to get a piece of ground that is dry, and which would never become wet nor flooded. It should slope gently to the south or southeast, with a hill or an elevation on the north and west of the Apiary to protect it from heavy wind storms and cold blasts, especially if the bees be wintered on their summer stands. A brook

or small stream of water close to the apiary is also very desirable, as the bees will not thus have to go far from their hives for water. Many bees are lost in the early spring by being compelled to go too great a distance for their supply of water. The cold chilling winds of this season are fatal to bees.

Having found a place like this with plenty of honey-yielding flowers within easy reach, we have an ideal location.

We must now study the flowers and find out when they bloom, and when we may expect a yield of honey or pollen from them, so that we may be ready for the honey flow when it comes and then we should manage our bees accordingly. As the honey flora is essentially uniform throughout the State, the management of the bees is practically the same. In this connection I might mention the most important honey and pollen yielding plants of our State. By the time spring has fairly begun, the tag alders and the willows blossom and the bees revel in their pollen, the first of the season. (Brood-rearing now begins in full blast.) This is followed by the opening of the soft maples, with their bounteous supply of both honey and pollen. Dandelions, sugar maples, fruit trees and dogwood, follow in close succession. A short intermission now takes place, then the raspberries come into bloom, followed closely by the clovers with their feast for the bees. Before the clovers cease to yield, buckwheat is beginning to give out its fragrance, and next the season closes with a sea of goldenrod and asters.

This is a list of the most important honey plants in my location, and I give it as a hint to the prospective specialist. It is what I consider a fairly good location for the bee-keeping business. This is by no means a full list of the honey and pollen bearing trees and plants that are visited by bees. There are many others of minor importance. I have omitted the Linden or Basswood tree, because very little of it grows in my locality, but it is one of our most profuse honey-yielders in parts of our State where it has not yet been cut down and destroyed by lumbermen.

If the prospective specialist has found a place like I have described, he need have no fear of the results, providing however he does his part well. But it should be remembered, however, that in a large apiary it requires a considerable area of a certain honey plant to produce surplus honey in paying quantities. In this connection we might examine the character of the soil. I do not wish to be regarded as out of the ordinary, but by close observation I have found that the character of the soil has nearly as much influence on the flow of honey as the state of the weather, notwithstanding the frequent assertion by good authority that climatic conditions control the flow of honey. Take, for example, white clover. I have found that on calcareous and clay loam soils it yields much better than on gravelly soils, and under conditions when on gravelly soils it does not yield at all. The same is true of sandy loam underlaid with limestone. It would, therefore, be well for the bee-keeper to take the character of the soil into consideration when selecting a location for his apiary.

The next important factor is the kind of bees. Much has been said about a general purpose bee, but as that race of bees does not exist we shall have to confine our selection to the varieties that we have at present. I have tried several of the different strains, but

have settled down to the conclusion that if I were located where clover is the main honey plant I would prefer the pure three-banded Italian. But as I am located in a part of the State where large quantities of buckwheat are grown, and clover is plentiful, I prefer a direct cross of Italians with the black, or German, for the Italians do not work well on buckwheat. By crossing them we have a bee that will work on buckwheat as well as on clover. I do not wish it to be understood that I keep all hybrids, far from it. I always buy and try to raise pure Italian queens. But I keep all queens that mate with black drones, and their colonies nearly always pile up more supers of honey than the pure Italians do. Therefore the selection of the race of bees best adapted to the bee-keeper's location depends somewhat upon the kind of honey plants found in that section.

Much of the bee-keeper's success depends also on the kind of hive used. But I shall omit to mention a choice of hive in the fear of getting on somebody's corns. Suffice it to say that the bee-keeper should use a modern, up-to-date, hive. After a crop of honey has been secured it seems to me that time and money should not be wasted in shipping it away to the large cities to be sold when it could all be disposed of near home by the apiarist himself by working up honey routes. Thus the transportation charges and commission could be saved. Another big item to help swell the bee-keeper's pocketbook. Establishing honey routes in a new territory is up-hill work for a time, but you will soon get all the customers that you are able to supply, as your product becomes better and more favorably known. Only a few years will pass until you will have no need to peddle honey, as your customers will send in their orders to your home, or come and get their supply. This is my experience along that line.

I believe that every large bee-keeper should make his own foundation, and by so doing one half the outlay of cash for foundation could be saved. It does seem to me a waste of money to sell our wax for 25c. per pound, and turn around and pay more than double that for foundation. By the possession of foundation mills with a warm room to work in, it could all be made at home during the winter. We would then have nice fresh foundation for the bees to work on, and no time lost by them trying to soften some old hard foundation in the height of a heavy honey flow when time means money. In the disposal of his honey, the manufacture of wax into foundation, getting sections, hives and supers ready for the next season, lies the partial solution of the problem, "What shall the bee-keeper do to occupy his time during the winter?"

As the success or failure of any kind of business depends largely upon the qualifications and general make-up of the individual that undertakes it, so is it in bee-keeping as a business. It does not require a man or women with greater physical strength than the ordinary man or women possesses, but it does require a person with strength of character. That is to say that he should have a large amount of push and energy in his make-up, and at the same time have a mild patient disposition, but be quick to act in an emergency. The bee-keeper should also be of a mechanical turn, as many little things about the apiary (and there are many), could be made by one handy with tools, thus saving the expense of buying.

A person that has a nervous temperament, who is easily excited, and goes about the apiary dodging every bee that may happen to come near him, will never succeed as a bee-keeper,—much less as a specialist. Therefore we can not close our eyes to the fact that many failures are due to the inadaptability of the individual to the business.

With the proper qualifications and a thorough knowledge of the subject, I can not see an excuse for failure.

In a paper like this it is not possible to give more than a few hints and suggestions, along the line of bee-keeping as a speciality, but the most important of these I have tried to enumerate. It should be understood however that bee-keeping as a business, does not offer the opportunity to become very wealthy. It does, however, offer the opportunity of an independent life and a good living, with a fair yearly surplus for a rainy day. Fortunately, the perfection of a man's happiness bears but little relation to the size of his fortune, and the bee-keeper, with the hum of the bees over his head, finds happiness deeper and sweeter than ever comes to the merchant prince with his thousands.

THE BEE AND HORTICULTURE.

By Gabriel Hiester, *President Pennsylvania State Horticultural Association, Harrisburg, Pa.*

From the way your president has stated my subject, I suppose he intended me to discuss it from an economic standpoint, and that is what I shall try to do. I do not know a more interesting subject than the relation of the Bee to Horticulture and the great part it has taken in the multiplication of varieties of fruits and flowers on the face of the earth. I do not know of any one thing that so forcibly illustrates the great wisdom and foresight of the Creator than this. Let us take an apple blossom, for example, which can be used as a type of all fruit bearing trees and vines. Here we have:

(1) In the centre a straight pin with soft head;
(2) 25 slender pins with oblong organs attached to the end;
(3) A drop of very sweet liquid at the base of the centre pin;
(4) The Bee with an instinct to gather this sweet liquid;
(5) The base of his legs and his belly provided with hairs;
(6) The fact that the Bee does not mix his drinks;
(7) The dual use of pollen;
(8) It does not discriminate between varieties.

It has been discovered recently that many trees, bearing apparently perfect blossoms, are not self-fertile, while the blossoms have the proper number of stamens, which furnish an abundance of pollen, this pollen is actually inert when placed on its own pistil, and in order to fertilize the embryonic seed the pollen must be

brought from a different variety. The Wild Goose plum is the most pronounced example of this peculiarity. The fact that in some places the Wild Goose plum bore abundant crops and in others was absolutely barren, caused fruit men for a number of years to believe that there were too kinds of Wild Goose plums, but after budding only from bearing trees, and setting out these young trees in orchards, they found the same singularity, and gave up that theory. Quite recently, within the past twenty years, one of the experimentors in the United States Department of Agriculture, at Washington, hit upon the true cause, and now any one can have Wild Goose Plums in abundance by planting a few plums of an other variety near them, and the bees will do the rest. Since the discovery in regard to the Wild Goose plum, it has been found that many varieties of pear and some of our best apples are partly self-sterile, and while they are not absolutely barren when planted alone, they yield much better when planted beside some other variety that blooms at the same time. I think it is only within the past ten years that the Bartlett pear has been placed in this list. We have no complete list at this time, but the U. S. Department of Agriculture is experimenting along this line and adding to the list each year. The fact is, it has grown so large that they recommend that in planting orchards no large block of any one kind shall be planted, but that we should plant not more than four or five rows of one variety then a row of something else, and so on, to allow an inter-change of pollen. While a great deal of this pollen is carried by the wind, the most effective work is done by the bees.

Strawberries cannot be forced in greenhouses without the aid of bees, even by the use of perfect-flowering kinds. There is no wind to shake off the pollen, and to have perfect berries it must be thoroughly distributed or each of the numerous seeds will not get its grain, and we will have a mis-shaped berry. By placing a hive of bees in the greenhouse just as fine berries can be grown as out of doors; better, in fact, because we have perfect control of the water supply.

I have already stated that the bee does not mix its drinks, but mile it will not mix apple nectar with any other nectar, it does not distinguish between variety, and is just as likely to travel across varieties as to go lengthwise with the row. In this way it has been instrumental in multiplying varieties. The fact is, with all our science and all our skill, we are indebted to the bee for nearly all of our best varieties of fruits. Study the pedigree of almost any highly prized variety, and you finally come to a chance seedling in some out-of-the way place. How did that chance seedling get there? The bees made a cross between known varieties growing near each other. A bird carried the seed and dropped it where it sprouted, grew, and finally bore fruit. Go through the list, and for every desirable variety that has beeen produced by the ingenuity of man, you will find one hundred that are the product of the bees.

So we see, when this old world was new the bee began its horticultural work and has kept it up without intermission through all the ages. The service rendered has been of inestimable value to man. It cannot be stated in dollars and cents, and the bee will certainly continue to work industriously along the same lines on

every fair day during the proper season while time lasts. I think I am safe in saying that future generations will be indebted to the bee for their best varieties of fruits, just as we are for the best at present, notwithstanding our advance in knowledge of the natural sciences; but of one thing you be sure: The bee will never give you a seedless apple.

Notwithstanding all its good and useful traits, the bee manages to make itself very unpleasant in the orchard at harvest time. This is especially the case with early peaches and plums. These are more inclined to rot than others, and they then prove very attractive to the bees. In picking the fruit, one is very apt to gather a bee in his hand with a peach, and a sting is the result.

They sometimes become very troublesome about the house when canning and preserving is being done. I remember an instance of this kind which occured a few years ago. A farmer living just across the river from Harrisburg kept a number of bees. One day they scented the preserving kettle on a neighbor's stove and they marshalled their forces and literally drove the family out of doors and kept them out until sun down. A damage suit in court was the result.

On a large fruit farm in Franklin county some years ago, at the time I visited it, they were canning peaches on a rather extensive scale, and the bees from their own hives annoyed the women who were paring peaches so that they could hardly work. Several were badly stung while I was looking at them.

I then and there decided that while I grew fruit for market I would not engage in the bee business.

Note.—The way to prevent such trouble, entirely, is to feed the bees with syrup or dilute honey, best by spraying it on the leaves of trees, when beginning such work.—H. A. S.

The bee has been charged, whether justly or not, with cutting grapes and sucking their juice, thus doing great damage to vineyards. I have never actually caught a bee in the act of cutting the skin of the grape, but have many times found them sucking the juice from grapes that had the appearance of being freshly cut, and I have never been able to decide what made that peculiar cut, which is always a perfect cross, on the upper side of the grape, if the bee did not do it. Circumstantial evidence is certainly very strongly against it. A bird could not make such a cut with its beak, and nothing else is ever seen sucking the juice except the bees. It would take many pounds of honey each year to repay the loss which I sustain from this source.

It is just because of the few very unpleasant traits last mentioned that I have left the bee severely alone.

Remarks by Prof. Frank Benton, U. S. Apiarist, Washington, D. C.: It is now definitely known that the Yellow Jacket is the insect that cuts or punctures fruit, such as the grapes referred to in the very excellent paper to which we have just listened with such interest, profit and pleasure, and the Honey Bee never punctures nor bites fruits of any kind. It can feed on the juices of fruits only when the skin is broken by some other agency. This was proven by putting bunches of grapes, some with punctured berries

and others with entire, in the tops of hives of bees. The punctured grapes were sucked dry and the entire were not attacked, even after some of the bees starved. Bees never attack when searching food, and sting only when squeezed, as described above. To avoid such trouble either work within screens or feed bees at the time.

SWARTHMORE DEMONSTRATION.

Before the Pennsylvania Convention.

In his remarks before the Pennsylvania State Bee-Keepers' Association, at its annual meeting held in Harrisburg, December 6 to 7, E. L. Pratt, of Swarthmore, said:

"I have been asked to prepare a paper on some queen-rearing subject for this convention, and I think I can not do better than to give a brief explanation and demonstration of the queen-rearing appliances we have used in Swarthmore with so much success and satisfaction.

"When I first entered the queen-rearing field the laborious methods employed quite discouraged me. To continue in the business I must needs hire help or devise means to rednce labor. The latter I set out to do, and the things here before you are the results of my efforts."

Both the old and the more recent queen-rearing methods were briefly reviewed and the necessity for a separable and easily removable queen cell was clearly shown. To avoid the delicate surgical operations, we were compelled to perform by old methods (previous to the emerging of the young queens), a wooden cup is now used.

The top application of the "Swarthmore" pressed queen cups was explained and the many labor-saving points of a flange cup were set forth by demonstration.

The process of waxing the cups, pressing the cells and grafting them without royal jelly was gone through with and numerous questions from the floor were answered. The use of the Swarthmore open-top holding-frames and the manner of applying cell-bars, incubating and confining cages to them through slits in the sheets, from the tops of the hives, without disturbance to the bees, was also demonstrated, and the simplicity and labor-saving points of each carefully set out.

The speaker then branched into the wholesale possibilities of the Swarthmore plan, showing how large numbers of queen cells may be secured and cared for.

A number of small cups, set side by side in a little frame, so as to resemble a comb in which the breeding queen will deposit eggs to save the long process of grafting by hand, attracted considerable attention and brought forth much comment and many questions. It

was shown how these little cups, each containing an egg, could be drawn from the frame, slipped into holding-shells and given to the bees for queen-rearing, and how other cups could be replaced in the frame for future use in cell getting.

Previous to his explanation of the miniature mating boxes the speaker quoted from his book, "Baby Nuclei," the following words of introduction:

"It was in 1881 that I first began to experiment with section-box nuclei for mating queens. Some three or four years later the plan I had been commercially successful with was published in the journals of that day and in pamphlet form, under the title of "Pratt's New System of Nuclei Management." Never to this day have I to any extent used more than a handful of bees in a little box for the sole purpose of making my queens. My little baby mating boxes have been condemned by nearly all the professionals, including Mr. Alley, in whose yard I had the pleasure of studying with profit for some three or four seasons. In the face of all this opposition I have clung to my little mating boxes and have improved them from year to year, until we now have what is called the "Ideal." Time and time again have I called attention to the woeful waste of bees, labor and material by the older mating methods—but I could get no hearing until a recent year. It so happened that I succeeded in mating a large number of queens from little boxes fitted into frames and hung on stakes, also attached in different ways to the sides of hives. My description of these experiments was admitted in part to "Gleanings in Bee Culture," which renewed interest in small mating nuclei, and the question now seems to command wide interest because of the wondrous saving in expense over any other method of queen mating."

In opening the queen-mating question the speaker said that twenty-five bees will mate a queen. Fifty will do it better, but more than a small teacupful is a positive disadvantage. The design of the Swarthmore mating nucleus box was shown, and the manner of hanging them to little T stands driven into the ground together with the manner employed to supply them with small combs and storing them with honey; also how bees are obtained and supplied in small lots to each little mating box.

While on the question of queen introduction, Mr. Pratt said: "It was Mr. Doolittle who showed us how to successfully introduce virgin queens to confined and broodless bees; Mr. Alley it was who taught us the use of the tobacco pipe for the same purpose, and it is hard for me to decide which is the greater gift. Both are golden.

"The folly of brushing the bees from small mating boxes directly they had mated a single queen is apparent," said the speaker, "when the same bees can be made to mate queen after queen, either by pre-introduction or by giving ripe cells." When the simple manner of giving cells to baby nuclei was demonstrated, applause followed.

After going through the different means employed in quickly feeding the babies with bulb and tube, or by means of little bottles, Mr. Pratt showed the convention how substantial bee hives are made by him from paper at a cost of only a few cents per hive, and of little labor; at the close of which a standing vote of thanks was given to "Swarthmore" for his interesting talk.

At the close of his remarks, Prof. H. A. Surface, M. S., Economic Zoologist in the Pennsylvania State Department of Agriculture, at Harrisburg, and President of the Pennsylvania State Bee-keepers' Association, paid "Swarthmore" a most glowing tribute.

The private secretary of Governor Pennypacker said he had come to the meeting for the purpose of conveying the regrets of the Governor, who was unable to attend, owing to pressure of business of State; it had not been his intention to stay more than a few minutes, but the absorbing interest of the topic had held him far beyond the usual leave, and he would certainly report to the Governor what he had heard at this meeting.

—From the *American Bee-Keeper.*

EDUCATION IN APICULTURE.

BY RICHARD D. BARCLAY, *State College, Pa.*

Our President in his address last evening covered most of the points which I had intended to discuss, but perhaps I can add some details upon certain features. The matter of education of the public is of very great importance, but I can add nothing to what has already been said upon this phase of the subject.

The Correspondence Lessons which have been referred to are a part of a system of lessons upon a variety of agricultural subjects which have been prepared and are conducted by the School of Agriculture of the Pennsylvania State College. Information in regard to any of these courses will be gladly furnished, upon request, by Prof. Geo. C. Watson, State College, Pa. The applicant for enrollment is furnished a card upon which he designates the course which he desires to pursue. When his card is returned the first lesson is sent, accompanied with a set of questions. The student is expected to study the lessons, answer the questions in writing, and return these answers for correction. Unless a satisfactory showing is made in the answers the next lesson will not be supplied. Thus, a question paper is sent with each lesson, and when each set of questions has been properly answered the next lesson is forwarded.

The lessons which I am now preparing are necessarily very brief and incomplete, but the fact that our State Agricultural College conducts a course indicates Bee-Keeping is a step in advance. I want to make them as helpful as possible to the student of Apiculture, and ask for free critisim in order that further editions may be corrected and improved.

A few days ago I talked to Prof. Watson, who has charge of the men taking the short course in Agriculture, about giving the short course students some instruction in Bee-keeping. He told me he would try to arrange for a very few lectures on Apiculture, to be given this winter, and that in future years even more time might be

given to this work. Thus we have the promise of some direct instruction at the State College at least to the short course men.

At the request of President Atherton, I have handed him some suggestions for a regular course of instruction in Apiculture, extending over two years, and intended to be a part of the proposed course in Horticulture. This course in Horticulture is intended to be primarily for women, and the value of instruction in Bee-keeping in connection with it is very evident. Dr. Atherton said he could not at this time give any information as to the prospect for the inauguration of this work, but he appeared to be hopeful. We have thus started a wedge for extended instruction in this subject to the regular four year students who may elect it.

The fact that there is a correspondence course, the promise of at least some instruction to the short course men, and the interest of the authorities in further work in this line, should cause us to congratulate ourselves upon our progress in our educational campaign during the eight months since our Association was formed.

At the Normal Session of Farmer's Institute Lecturers at Bellefonte last October I made an address upon Bee-keeping which appeared to interest those present in this much neglected branch of Agriculture. Through the kindness of our friend, Mr. E. L. Pratt, I was able to show one of his "Baby Nuclei." The ease with which these bees were handled, and the fact that they clung to the comb while being passed about for examination, were object lessons to those not familiar with improved bees.

Deputy Secretary Martin, who is the Director of Farmer's Institutes, told us at this meeting that he would be pleased to aid us in disseminating knowledge of Apiculture by sending persons qualified to speak regarding bees, to Institutes in every county of the State, if we would and could provide the men fitted for such work. We thus have the State Department of Agriculture back of us in this educational movement. I am scheduled to speak at several institutes this winter, and shall endeavor, with the aid of a model of a movable frame hive and fixtures to illustrate the difference between the methods now most common throughout the country districts and those improved methods with which we are familiar.

If the fear of stings can be overcome by showing the possibility of improved bees, the erroneous ideas regarding swarming and its attendant excitements dispelled, and a method for controlling swarming either by clipping wings, or shaking bees, or both, be shown, a great step will be made. With constant instruction in Apiculture at Farmers' Institutes we may look for improvement of the methods of Bee-keeping in our rural districts. For the opportunity to effect this advancement we owe our thanks to the Hon. A. L. Martin, and for the origin of the general crusade of Apicultural education in the State College as well as in the State Department of Agriculture, to our efficient and worthy President, Prof. H. A. Surface.

IMPROVEMENT OF HONEY BEES.

By Frank Benton, (*In Charge of Agriculture, U. S. Department of Agriculture.*)

Before a body of practical men engaged in the cultivation of honey bees for profit chiefly, without, perhaps excluding the pleasure and interest to be derived from the keeping and handling of these insects, I judge that a presentation of this subject in a manner such as will appeal to the conditions and limitations under which most of us are obliged to work, with specific recommendations as to what may be practically carried out in our own apiaries, will be a much better plan than to present, theoretically and abstractly, any scheme for the improvement of bees through a complicated and perhaps long series of breeding experiments. With this main purpose before me, I ask your consideration of certain conclusions which I have reached after more than forty years' work in the apiary, during over thirty years of which I have been engaged in the rearing of queen bees of various races and crosses between those races. Personal examinations, and, in some instances, several years' experience, in the native lands of nearly all of the races in common cultivation in this country, has assisted me considerably in arriving at conclusions of a definite character, and reasonably satisfactory to myself. Likewise, the experiments that I have made in crossing various types during this period, and particularly during the twenty years past, have led me to some conclusions which I think may be profitably employed in our selection of breeding stock.

The subject naturally divides itself into: first, the selection of a race or breed; second, the selection of individual queens to breed from; third, the methods employed in rearing queens; and, fourth, the selection of drones, or male bees.

SELECTION OF RACE OR BREED.

Caucausians for beginners.—One of the first points suggesting itself to a person about to begin the cultivation of bees is what race or breed is best, and, while I would not suggest that one having no experience should undertake the work of improving the race or breeds which have been cultivated for so many years by those of long experience and accurate knowledge of bee-life, still, the practical question arises with the beginner how he can keep to the best type, or at least approach it, while learning how further improvement may be effected. There comes also to his mind, at least in many instances, a dread of cross bees and the fearful stinging which may result from unskillful manipulation of bad-tempered races. Since, however, there exist bees so gentle as to remove all difficulties in this direction, and which are, at the same time, productive workers comparing favorably with most others, there need be no question

whatever but that the most advisable thing is for the beginner to adopt one of these races. The gentlest are the Caucasians, imported originally from the Caucasus, a Russian territory lying between the Black and Caspian Seas, partly in Europe and partly in Asia. They have been cultivated to a greater or less degree for some twenty-five years in Europe, and, although imported into the United States a number of years ago, but little has been done in the way of multiplying them and introducing them generally. Their manifest place, however, in popularizing bee-keeping in cities and towns and among the rural population, wherein fear of stings is the chief obstacle to a more or less extended introduction of bee culture, makes the Caucasian race preeminently one which should receive much consideration. In view of this, the United States Department of Agriculture has recently imported quite a number of breeding queens, and plans an extensive introduction and testing of this variety in various portions of the country. The most prominent particular in which they differ from other races is their gentleness. It is quite possible, without the slightest fear of stings, to open the hives at any time during the working season, without the use of smoke and with no protection to face or hands. The bees may be given the roughest possible treatment—shaken, brushed and tumbled about, as though they were so many beans, yet no resentment will be shown. The queens are exceedingly prolific, and the workers industrious. They are, therefore, decidedly to be recommended for all novices in bee manipulation.

Carniolans for Comb Honey.—Should the purpose of the bee raiser be the production of the very highest grade of comb honey Carniolan bees, or bees largely composed of this blood, are to be recommended. The qualities for which they are noted are prolificness, hardiness (both as regards the individual workers and as regards whole colonies). Their industry is marked. Their gentleness, when pure in blood, is acknowledged by all who have had genuine Carniolans. In this respect they are second only to the Caucasians, and, as a race, quite in advance, in gentleness, of the best Italians.

The question might be raised here why I would not recommend, in preference to the Carniolans, the Italians, so long and favorably known in this country. While admitting that many strains of the Italians quite exceed others in productiveness, gentleness, hardiness, and honey-yielding powers, I cannot in these particulars rank them as averaging equal to the Carniolans. Their disposition to cease brood rearing, wholly or in part, at critical times and their great predisposition toward dwindling in early spring oftentimes makes it very uncertain whether their colonies will or will not be in proper shape for the given harvest. On the other hand, the native hardiness, the race prolificness, and the steady brooding qualities of the Carniolans, enables any one who manipulates them rightly to bring them into any given harvest with a large force of field workers ready to take advantage of that harvest. They are, therefore, to be depended upon, if managed in accordance with their race-peculiarities.

While recommending Carniolans particularly for comb honey, because of the fact that they seal their completed combs in a snowy-

white manner, there can be no objection to their employment in the production of extracted honey or in apiaries where both comb and extracted honey are produced. There are, however, some strains or types which, as regards absolute quantity of honey, yield more. I refer to those bees containing a greater or less percentage of eastern blood.

Cyprio-Carniolans for Extracted Honey.—By mating Cyprian queens to Carniolan drones a combination is produced of the prolificness, great energy in honey gathering, and general activity of the best of the eastern races, with the most hardy and prolific of the western races. The noted gentleness of the latter is also largely preserved in the cross. The loss in this combination is seen when we examine critically the solid sections of the honey produced by these workers. The somewhat watery appearance common to work of eastern bees is at once detected, and, although the quality of the honey itself is quite equal to that gathered by any bees, the appearance of the combs for a critical market is somewhat inferior. Except in this respect, and also in that the workers having eastern blood are rather more free in the use of propolis than the bees of Europe, and likewise are not always as easy of manipulation, bees of this cross are to be ranked as decidedly the most valuable and wonderful honey producers thus far cultivated.

Bearing in mind these general hints here presented regarding types, the person proposing to breed the best bees for a given purpose will surely be able to make a suitable selection of a race or breed.

SELECTION OF BREEDING QUEENS.

The greatest possible care should be observed in the selection of the queen-mother, both as regards the queen herself and also the qualities and race-characteristics of her progeny.

The Stock.—In deciding whether a given queen is worthy to be the mother of all, or a great part, of the queens which shall head the honey-producing colonies, a critical examination of the stock itself should be made. Since the prime quality must necessarily be the honey-gathering powers, this will receive the first consideration. In estimating this, it is hardly necessary for a man of experience to test with the scales the actual number of pounds of honey produced. He may judge merely by a careful comparison, during a given honey flow, of the activity and relative amount of honey gathered in his apiary by individual colonies. He can also see, by the general activity and energy displayed by the separate colonies, which are doing the most. Having selected those which in this particular meet his approval, he should choose from these a colony which shows the general race-characteristics of the breed to which it belongs. By this I mean that the colony must possess, in a marked degree, those important and valuable traits which have caused the selection of this race. Just here perhaps I would differ from some others, in that, instead of recommending the selection in all instances of the particular colony in the apiary which has yielded the most honey I might select one which had given a smaller number of pounds under the same circumstances than many others, but which presented a uniform and well developed type of the race in question, with no marked inferiority in honey production. Having

determined upon these two important characteristics, I should consider as coming next, the gentleness of the given colony. Here, invariably, other things being equal, I would select the very gentlest. It should also be borne in mind that this term "gentleness," as here used, is a relative one, for a colony belonging to the Cyprian race could hardly be expected to come up to any such standard in this particular as the Caucasian, Carniolan, nor even the Italian taken all in all. As an illustration of what should be required in this respect, I would state that one of the tests to which I invariably subject a colony of Carniolans whose queen I intend to use as a breeder, is how well they bear manipulation after dark. Of five colonies whose queens and bees might come up to the standard in all other particulars, it will usually be the case that two or three will hardly meet the test of manipulation at night. Standing a lighted lantern or lamp on one corner of the open hive, the frames are lifted, one after the other, with only the use of a small amount of smoke, as would be the case in manipulating during the daytime. The bees must remain appreciably as quiet on the combs as during the daytime, and, above all, must not fly in great numbers toward the light. There are many other tests to which they may be subjected, and this is merely cited as an instance of one direction in which the race-characteristic should be examined.

The Queen.—The queen, likewise, must show, in a preeminent degree, her race-characteristics; that is, she must be prolific for one of her race. This implies, if she be of the Cyprian race, that she is far more prolific than the average, or above the best, Italian queens —more prolific even than the largest and most productive Carniolan. If, on the other hand, she be of the Carniolan race, size, rotundity of form, general robust look and activity are to be considered. While it is expected that she will be more prolific than an Italian queen, yet equal prolificness with any of the eastern race is not counted upon, notwithstanding her extra size. I have never found a queen-bee that was too prolific to suit me. The building up of powerful colonies depends upon this prolificness of the queen, and it hardly needs mentioning here that it is only through having a powerful field force that large yields of honey may be obtained. I must, therefore, rate extra-prolificness in queens as their most valuable trait. Along with this I look for strength of body, limbs, and wings, in fact, a general compact, symmetrical and well-developed form, combined with activity. Such a queen, showing, herself, all of the race-characteristics of the breed to which she belongs and whose workers likewise show race-characteristics of their class, will be very likely to reproduce herself in her queen progeny, and, through the latter, will give colonies which are typical of the race to which they belong.

MANNER OF SECURING CELLS.

If considerable numbers of cells are required, it is always better to have a colony of Carniolan bees, Caucasians, or some one of the eastern races as cell builders, since they produce much greater numbers, even fifty to one hundred cells in a single batch being quite common. Being also excellent nurse bees, the food supplied to the developing larvae is abundant, insuring more perfect development than is the case with the nurse bees of less prolific races. The first step is to make queenless a very populous colony; on the third day

thereafter the colony may be put into condition to receive queen cells. There is no need of rejecting many of the cells which may chance to have been formed in this colony, since, if properly managed, they may be made to produce most excellent queens. For convenience, these incipient cells may be cut out and attached with melted wax at regular intervals on a top bar. The larvæ ranging in age from forty to sixty hours are to be removed with a slightly bent toothpick, and, in their place, are to be put, with the same instrument, larvæ from twelve to thirty-six hours of age, taken from the colony of the chosen queen. This substitution of young larvae insures a full amount of food from the very beginning—even a superabundance. In choosing the cells to be placed on the bar, only those having large bases upon which a normal sized cell may be built, should be taken. Here, again, race-peculiarities have to be considered, since the queen-cells ordinarily formed by eastern bees are not as large in diameter as those produced by Carniolans. It is therefore well to use care in this selection.

The next step consists in the removal of all unsealed larvae from the populous colony which has been queenless during the preceeding two or three days. The object of this removal is to force the bees to turn their whole attention to the fifty or more queen cells that are supplied on bars. Should honey-gathering not be going on freely, the colony engaged in the nursing of these queen cells is to be fed daily a pint or more of syrup, care being taken, likewise, that an abundance of pollen is present in the hive. If the weather is cool and changeable, particularly if the temperature is low at night, extreme care should be taken to afford the bees every facility for the retention of the natural warmth of the brood nest. Since, in substituting larvae from the breeding queen chosen, those larvae having an age of twelve to thirty-six hours had better be selected, it may be counted that the young queens will all emerge twelve and one-half to thirteen and one-half days after the transferring or substitution of the larvae takes place. It will, therefore, be easy to provide nuclei (or queenless colonies) for the reception of each one of these queen cells. If, however, it is inconvenient to do this and the cells have been placed at regular intervals upon the top bars, it will not be found difficult to provide a small queen nursery, which may merely consist of a series of wooden cages with wire-cloth sides or small wire-cloth compartments, having a cell or cup in which a small quantity of food may be placed, the cages being placed at such intervals that the bar containing the cells when placed over the cages, permits each cell to slip into a separate compartment. It is by no means advisable to place the cells in a queen nursery until the young queens are practically at the very point of emergence, since the slightest neglect or chilling a day or two previous to the final awakening of the maturing queen, if not fatal, is highly injurious to the future usefulness of the queen. All are familiar with the indifferent results in the case of the chicks of common fowls should chilling of the eggs occur shortly before the period of hatching. With bees still greater sensitiveness in this particular exists, and it is, therefore, a very mistaken policy to separate the maturing cells during any stage, except that of actual emergence, from the direct and free contact with the clustering bees.

After emerging, the young queens are to be allowed a period of a

week to fifteen days for mating. The impulse to fly and mate will be greater if the colonies are in a thoroughly prosperous condition, that is, are well supplied with honey and pollen in proportion to their numbers. While queens of the European races usually mate in from five to seven days after emerging, those of eastern races more often require nine to fifteen days. It follows from this, as well as from the fact that eastern types are possessed of greater native vitality, that the young unfertile queens of the latter will bear, without injury, longer confinement previous to mating than will those of European types. Twelve to fourteen days may often be admissible for the former, while seven to nine days should usually be the limit for the European races. But, in all cases, the less confinement after four or five days the better, and during this period in any instance it will be preferable, in order not to injure the young queens, which it must be borne in mind are not yet wholly developed, although they have emerged and present the appearance of being perfect queens, to have them caged in wire-cloth pipe-covered cages pressed into the surface of a comb, where abundant supply of food is always at their command.

It is hardly necessary to add that an examination of each young queen should be made immediately after she has emerged in order to waste no time in the preservation of those happening to issue with defective wings or legs or ill-developed or crooked bodies. One may even go farther than this, should the supply of young queens be quite abundant, and reject all that do not present the most promising appearance.

SELECTION OF DRONES.

Quite the same care should be given in the selection of the drones (or males) as in the selection of queens. It is true that we may not wholly control the mating, since the queens frequently leave our own apiary while flying out on mating excursions, but in case a certain race is bred in its purity and surrounding apiaries are stocked with those of a different type, it will be quite easy to reject any queens that have mated with drones of another race, retaining, for our own breeding purposes at least, only such as have mated with the stock purposely reared in our own breeding yard. It is, therefore, decidedly advisable to limit drone production to queens which have sprung from colonies coming up to our own idea of what we desire in the shape of workers in our honey-producing colonies. Repeated experiments in crossing various types have convinced me that the drones have greater influence over the temperament and constitution of the workers than have the queens. It follows from this that in these two particulars the general characteristics of the colonies selected as drone-producers must be preeminent. By this I mean that both the queens to produce these drones and the workers related to these queens, must come up to the general race-characteristics, and must in these cases show most excellent qualities as regards hardiness of constitution, general robustness, and wind-power, combined, in the case of the workers, with the greatest gentleness which it is possible to procure. We are endeavoring not merely to secure the gentleness characteristic of the given race which we have selected, but we wish exceptional gentleness within that race. But it is quite impossible to judge by the drones them-

selves or the queens producing them, what degree of gentleness these drones may transmit. We must infer that certain drones will transmit gentleness of the workers having the same blood as the mother of these drones, are excellent types of gentleness of the given race. These workers are the sisters of our proposed drone-mother, hence aunts of the drones, and are of course in the colony from which the proposed drone-breeder sprang. The half-sisters of the drones themselves (constituting the worker-progeny of the proposed drone-mother), form but a slight guide as to what qualities of temperament the drones may transmit, because the good or bad temperament of these workers will have come largely (according to the above theory of preponderance of male influence over temperament) from the drone with which the queen has mated. To judge, therefore, whether the drones have gentle blood and hardy constitutions, we must go back to the worker-progeny of the grandmother of these drones—the sisters of the drones' mother.

It is also highly desirable that the element of prolificness should not be lost to any degree, since it certainly appears reasonable that, while we look to the mother of the young queens largely for this quality, still on the male side considerable influence may also be exercised. We may judge of the capability of drones for transmitting prolificness by careful examination of the work of the queen producing those drones. Prolificness in our young queens reappears of course in queen-progeny in the shape of prolificness, but this quality reappears in the workers as a material instinct, impelling them to greater care in brood-nursing. It is, therefore, to be reckoned with as valuable, whether we are using these young queens merely as producers of other queens or to produce colonies for honey production, since the ability of the workers composing the colony to care for vast amounts of brood has plainly its influence over the yield of surplus.

HOW TO MAINTAIN A CYPRIO-CARNIOLAN APIARY.

The question might be asked how we are to maintain a honey-producing apiary headed by queens of one race mated to drones of another, as is the case with the Cyprio-Carniolan type, which I have commended as an excellent one for its hardiness, prolificness, and great honey-gathering capacity. The answer is simply that the home apiary (or breeding apiary) must be stocked wholly with Carniolans as an apiary in which the drones for this combination may be bred, and all queen breeding, or at least mating, may be accomplished. A very limited number of pure Cyprian queens may be kept at one of the out-apiaries, and from these the queen-mothers are to be selected for use in securing cells for the young Cyprian queens, which are then to be mated at the Carniolan yard. And, since none of the young queens (whether mated to Carniolan drones or not) are to be used as queen-mothers, no heed need be given to the manner in which they have actually mated, at least none of these queens need be destroyed by reason of mismating unless they produce quite objectionable bees.

It will be observed that I have outlined a plan of producing and mating young queens which implies merely the rearing of fifty to one hundred in a single lot. These numbers are capable of multi-

plication by merely using additional colonies; yet, were I recommending a system for an extensive breeder of queens, certain modifications might be adopted, even to the extent of establishing permanent or temporary nuclei, as the case might seem best, and the use of artificial cell-cups, with many other paraphernalia not needed in such limited operations as I have here outlined. My purpose has been rather to indicate how the quality of our queens may be maintained, or even advanced to such degree as to materially increase the actual output in pounds of honey.

With due attention to the breeding of the queens heading our colonies, with large hives and stimulative feeding during honey dearths, the question of keeping large numbers of colonies in one place is, to a very great degree, solved. I am also thoroughly convinced that with greater heed to the principal one of these factors which I have just mentioned—the rearing of the highest grade of queens, there would be far less complaint of poor seasons and small honey yields than is now the case.

HONEY-BEARING FLORA OF ADAMS COUNTY.

By Rev W H. Bender, *New Chester, Adams Co., Pa.*

For all practical purposes, the honey-bearing flora of this region may be summed up under the head of nine familiar trees and plants. Given in the order of their season the list would stand about as follows:

1. Soft maple, about March 15.
2. Fruit trees, plums and cherry, about April 28; apple, May 6.
3. Clover, white and red, June 1.
4. Locust, May 28.
5. Raspberry, May 28.
6. Wild Cherry, May 28.
7. Sumac, July 6.
8. Catnip, July 9.
9. Aster, September 1.

Given in the order of their honey-yielding properties, the list would stand somewhat as follows:

1. White clover.
2. Aster.
3. Fruit bloom, catnip, raspberry, red clover.*
4. Soft maple, locust, wild cherry.

In this region I have not known Golden Rod to yield honey. We have an abundance of it. A few bees in season may be seen working it for pollen only. As to buckwheat, its honey-bearing properties

*Red clover is here assigned according to its available yield to the bee and not according to its honey-bearing property.

are well known, but so little is cultivated with us that I have not included it in the list.

During the summer of 1903, we had an unfortunate secretion of honey dew. The bees going wild in their haste to store it, to the neglect of any honey-bearing flower in season at the time.

We will now consider separately the various sources of honey as named in the given list, being as brief as possible. Standing at the head, we find white clover. It is pre-eminently the honey-bearing flower or plant of the region. It grows in profusion, covers wide stretches of cultivated soil with its mantle of green or snowy white flowers, blooms from 8 to 10 weeks, and generally gives the bees a honey harvest of from four to six weeks. Referring to my notes of the past summer, I find it began blooming May 25, and continued in bloom until about August 1. Its honey-yielding period extended from about June 1 to July 6. Were it not for white clover, bee-keeping with us in Adams county would be a losing game. It is our main—I was about to say, our only source of surplus.

And right here we find a hopeful sign. During the last few years the plant seems to have taken on a new lease of life. Old resident farmers and old-time bee-men say they never knew white clover to grow so profusely and vigorously as it has in the last few years. May this not point us to one of the mysterious workings of Nature wherein she makes good in one way the loss sustained from some other source? Years ago the country was covered with a dense forest. The honey bee had an abundance of pasturage. As the forests began to disappear bee-keepers lamented the scarcity of pasture. This has remained the common complaint among those who keep bees in a small way. May it not be, however, that Dame Nature is slowly but surely making good in white clover the loss sustained to the bee-keeper in the removal of the forests?

The next in value with us is a fine flowered aster. I do not know to what extent this plant may be found throughout the State, nor do I know what other names may be given to it in other localities. With us the plant grows in abundance. It is to be found by the roadside, in pasture fields, grass fields, waste places, etc. It attains a height of from 2 to 6 feet, bears a small flower—hundreds of them on one small stalk—that yeilds a honey distinct in flavor and consistency. In color this honey is golden, in flavor very pronounced sweet and sugary. It has a heavy body and when extracted granulates quite readily. This plant comes into bloom about August 25, and from September 1 until frost the bees have a rich harvest generally.

Again referring to my notes, I find that as to the past summer, September 1 was the first real busy day for the bees on this plant, and that the flow continued until September 28, when a cold wave struck us, a forerunner of the severe frost of October 3, which put the bees out of business for the season. We do not count on much surplus from this plant, and yet it is, as per the list already given, second in value to the bee-keeping industry of this region, from the fact that it furnishes the bees a source of winter supply. Its value in this respect will be readily seen from the following data: July 20, when I took off the surplus honey—white clover—the hives as a rule were fairly well filled with stores. September 1, the beginning

of the aster flow, the bees had well used up other stores, the result of a honey drouth from about July 15. At the end of the aster flow the hives were again full, and a few had begun operations in the supers when that cold wave struck us. White clover for surplus and aster for winter stores. These are our two main sources.

The principal value of soft maple is its early availability, yielding honey and pollen by the middle of March, and thus stimulating brood-rearing and giving colonies short in stores a limited source of supply sufficient for the time at least.

The same may be said of fruit bloom, coming as it does the latter part of April and fore part of May. There is this difference, however, in that the bees usually gather from this source a goodly quantity of fine, rich, honey for present use, filling the combs oftimes one-third full. But right here we are face to face with a dire calamity threatening the bee-keeping industry of Adams county. This is a fruit-growing region, and the spraying of fruit trees while in bloom is becoming more general. This is death to the bees. There must be some legislation along this line, or our industry is doomed.

Locust is uncertain. The raspberry, though sure and of good quality, is of limited extent. Sumac and catnip are valuable in that they come at a time when there is a dearth in the honey flow. Especially in this true of catnip. Its time and length of flow, early part of July to middle of Sept., about ten weeks, makes it no mean asset to the bee-keeping industry. I am convinced that many bee-keepers do not appreciate this plant as they should. Speaking with a friend upon this subject during the past summer, he said: "Oh, yes; I see the bees working on it much during the summer, but have never known them to make much out of it." This was the remark of a hasty conclusion. In the first place, with us it does not grow very abundantly, and in the second place, it comes, as we have already seen, at the time of a honey drouth, so that the bees seldom store any of the nectar in the surplus, and hence the above conclusion. But while very little is obtained in the surplus, it does furnish a reliable source for the brood nest, and in addition to this gives the bees some employment at a time when otherwise they would be in a large measure idle. My conclusion is that if there is one honey plant worthy of cultivation for its honey yielding qualities alone, catnip is that plant.